THE

INTERNATIONAL ENCYCLOPÆDIA

OF

SURGERY.

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VOL. II.

THE

INTERNATIONAL ENCYCLOPÆDIA

OF

SURGERY

A SYSTEMATIC TREATISE

ON THE

THEORY AND PRACTICE OF SURGERY

BY

AUTHORS OF VARIOUS NATIONS

EDITED BY

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ILLUSTRATED WITH CHROMO-LITHOGRAPHS AND WOOD-CUTS

IN SIX VOLUMES

VOL. II.

PREFACE.

THE present Volume of the ENCYCLOPÆDIA opens with articles upon those affections, such as Wounds, Burns, Abscesses, and Gangrene, which, though local in themselves, may be met with in any region of the body. Then follow elaborate articles upon the various Venereal Diseases—Gonorrhœa, The Simple Venereal Ulcer or Chancroid, Syphilis, Vegetations, etc.—and in the latter part of the Volume is begun the consideration of Injuries and Diseases of the Various Tissues of the Body.

The Editor has to deplore the loss by death of three collaborators—surgeons of eminence and wide reputation—who had engaged to contribute articles to this Volume, but who have died while it has been in course of preparation.

The first of these, the lamented OTIS—the justly distinguished author of the Surgical History of the War—responded with enthusiasm to the Editor's request that he should undertake the article on Gunshot Wounds; but failing health interfered with his ability to work, he put off the task from time to time, and Death at last took him with his article unwritten. His place among the contributors to the ENCYCLOPÆDIA has been ably filled by Professor Conner, of Cincinnati, who adds to a thorough familiarity with the literature of his subject, a large practical experience in Military Surgery.

The article (Injuries and Diseases of the Bursæ), which had been assigned to the second—Dr. H. LENOX HODGE, the Editor's colleague

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and friend for nearly thirty years—has been kindly undertaken by Dr. Nancrede, of Philadelphia, who has dealt with the subject in a thorough manner which cannot but be approved by the critical reader.

The last to be mentioned—the late Prof. JOHN T. HODGEN, of St. Louis—whose recent sudden death is fresh in the memory of all American Surgeons, had happily completed the article (on Ulcers) which he had agreed to furnish, and it will be found in its proper place.

The names of all of these eminent men will long be preserved and honored in the annals of American Surgery.

The illustrations which accompany this Volume will, it is hoped, commend themselves to the reader, both by their artistic excellence and by their practical value as a means of interpreting the text. Most of the plates, as well as several of the wood-cuts, are from drawings executed by the Editor's former pupil, Dr. Taylor, while a large number of the cuts in the article on Gunshot Wounds have been liberally and courteously furnished by the Surgeon-General of the U. S. Army, and represent specimens contained in the unrivalled collection of the Army Medical Museum.

<div style="text-align: right">JOHN ASHHURST, JR.</div>

PHILADELPHIA,
  2000 WEST DELANCEY PLACE,
    July, 1882.

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THE INTERNATIONAL
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THE INTERNATIONAL

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CONTUSIONS.

BY

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A CONTUSION may be defined to be a laceration of the subcutaneous tissues without solution of continuity of the skin. When the force which produces the contusion divides the skin, the injury becomes what is known as a *contused wound*. If the cuticle alone is implicated, the injury is an *abrasion*. But while the skin is not primarily broken in contusions, it is frequently so injured that its vitality is destroyed, and that sloughing takes place subsequently.

CAUSES OF CONTUSIONS.

Contusions are caused in a variety of ways: by blows, falls, or violent pressure. The force which produces a contusion may be *direct*, as is seen in the case of the "black eye" which follows a blow of the fist, or in that of the laceration of the muscles of a limb produced by contact with a partially spent cannon ball; or it may be *indirect*, as in the case of a fall upon the hand, when the arm is extended, causing contusion of the shoulder; or in that of a fall from a height, the patient striking upon his buttocks, producing injury of the skull, with concussion and contusion of the brain. We see examples of contusion from severe pressure, in railway injuries, in those caused by machinery in rapid motion, and in those which result from the passage of the wheels of a vehicle over the body. A good illustration of contusion by pressure is sometimes observed, after difficult parturition, in the bruised scalp of the infant, and in the swollen vagina and vulva of the mother—the injury in some cases terminating in sloughing and the formation of vesico-vaginal or recto-vaginal fistulæ.

DEGREES OF CONTUSION.

The *degree* of a contusion may vary from a slight bruise or pinch of the skin and subcutaneous fascia to a complete crushing and disintegration of a part, according to the amount of violence employed, the resistance of the tissues, and the health of the individual injured. Persons whose blood has been impoverished by long-wasting disease are easily bruised. Fat, anæmic women, young or old, especially if bed-ridden for any length of time, are the subjects of frequent *ecchymoses* produced by the most trifling causes—such as turning over in bed, if the mattress is hard or uneven; or the grasp of the nurse's hand, in assisting them to move. These bruised spots, or ecchymoses, appear chiefly on the hips, back, and arms; but may come on any part of the body. Individuals who are subjects of the scorbutic or of the hemorrhagic diathesis, are peculiarly liable to ecchymosis; but purpuric spots and patches must not be confounded with the discoloration of a bruise. The term *bruise*, or *ecchymosis*, is applied to cases in which the contusion is slight, and in which but a small quantity of blood and blood-stained fluid is effused into the subcutaneous tissue; a contusion which is indicated by the familiar bluish-black discoloration which follows. If the contusion is more severe, involving deeper structures, laceration of larger vessels occurs, and a greater quantity of blood is poured out. In these cases the discoloration which attends the extravasation may not be seen for several days, as it takes some time for the effused blood to make its way through the tissues to the surface. The discoloration may also appear at a distance from the site of injury. When the extravasated blood is coagulated, it is known as a *thrombus;* if it is collected into a cavity and remains fluid, it is called a *hæmatoma.* The more vascular and yielding the part—other things being equal—the greater is the hemorrhage. The blood which escapes from the bloodvessels and is confined in the tissues, coagulates over and compresses the lacerated vessels, and in this way, to a great extent, the bleeding is stopped.

When the contusion is of the highest degree, and the part is completely crushed and disorganized, it is said by some authors to be *pulpefied.* In these extensive injuries the skin may also be involved, and show some signs of lesion; but frequently its great strength and elasticity enable it to escape unhurt. The skull may be crushed into numberless fragments, and the brain may be lacerated by a portion of a shell, and yet the scalp may remain apparently uninjured; or the wheel of a carriage may pass over a limb, breaking the bones and reducing the soft parts to a pulp, while the skin continues unbroken. When a contusion is severe, the muscles and other soft parts being broken up, a large bloodvessel may be ruptured, and hemorrhage, even to the extent of causing fatal syncope, may ensue; or the contusion and disintegration may be followed by rapid sloughing, or even by acute gangrene of the parts. In such cases the bloodvessels sometimes appear at first to have escaped injury; but they speedily succumb to the mortification which follows. In some instances there are lacerations of internal organs, such as the lungs, liver, spleen, bladder, brain, or spinal cord, leading perhaps to extravasation of blood into a serous cavity.

If the case is one of simple bruise, or ecchymosis, the bleeding takes place in the areolar tissue just below the skin, and usually in small quantity; but Mr. Erichsen has related a case in which a school-boy was beaten to death by his teacher, and in which, at the post-mortem examination, the subcutaneous areolar tissue of the arms and legs was found separated from the fascia below, the space between being filled with extravasated blood. Death in this instance was attributed principally to the interstitial hemorrhage.

SYMPTOMS OF CONTUSIONS.

The *symptoms* which generally follow contusions are shock, pain, swelling, and discoloration.

SHOCK.—Unless the individual has some unusual nervous susceptibility, *shock* is rarely present in cases of slight contusion; and even in those of a more serious character, it is not generally as severe as the gravity of the accident would lead us to expect. If some of the internal viscera, however, are involved, the shock may be at once fatal, or may become so after a feeble attempt at reaction.

In the case of a soldier whom I saw, struck by a Minié ball on the metal buckle of his sword-belt, the injury producing contusion of the front wall of the belly, with violent concussion of the abdominal contents, but without any appreciable lesion of the internal viscera, death from shock followed in a few moments.

Contusion of the testicle is attended by severe shock and by nausea and vomiting, with great loss of muscular power, and with a tendency to fainting.

PAIN.—The effect first experienced from a contusion is commonly more or less paralysis of motion and sensation. A violent blow upon the leg may cause the recipient to fall from sudden loss of muscular power. The numbness or dead feeling which first follows the blow is soon succeeded by heavy, aching *pain*, severe and lasting according to the violence of the injury and the nature of the part struck. If the trunk of a nerve be involved in the injury, the pain is burning and tingling, and may extend to the terminal branches of the nerve. If the soft parts alone are contused, the pain soon disappears, and, if the injury is slight, is relieved by rubbing with the hand. But when fibrous tissue, such as that found about a joint or a superficial bone, is involved, the part remains tender and intolerant of any manipulation or pressure for a long time.

SWELLING occurs soon after the injury. At first the parts may be condensed or compressed by the blow, as is sometimes seen in injuries of the scalp, where, the skin and cellular tissue being compressed, and the vessels paralyzed at the seat of injury, swelling takes place in the parts around. This condition may easily be mistaken for fracture with depression of the bone, or, even if fracture be present, the depression may be thought to be greater than it really is. This compressed state of the soft parts, when present, slowly passes off, and the part then becomes swollen from the effusion of blood which escapes from the ruptured vessels, and from the exudation of serum and fibrin which are poured out from the bloodvessels of the contused parts. It is to the latter cause that the swelling of contusion is principally due. The "bump" produced on a child's head by a blow, and the welts on an animal's skin caused by the lash of a whip, are the result of exudation of bloody serum poured out from the vessels of the contused part, the violence inflicted causing rapid determination of blood to the site of injury, and sudden distension and elongation of the bloodvessels. The extent of the swelling will depend upon the size of the injured vessels, the violence of the lesion, and the looseness or firmness of the tissue involved. In the eyelids, scrotum, penis, and labia, the swelling is generally very great.

The extravasation comes for the most part from the veins, the walls of which are more easily injured than those of the arteries. When an artery of any size is lacerated, blood is poured out rapidly, forming a spurious aneurism,

with distinct pulsation. The blood accumulation thus formed may, according to the character of the tissues in which it is placed, be circumscribed, or spread over a large surface, and may, after a time, settle by gravity to the most dependent position.

Medico-legal Import of Extravasation and Ecchymosis.—When a blow or other injury is inflicted on a body after death, venous blood in small quantities may be effused under or upon the skin, but not into the substance of the *cutis vera*. When the extravasation is extensive, or the skin thickened, having greater firmness and tenacity from infiltration of blood, it is fair to conclude that the injury has been received before death. This condition of the true skin, while not necessarily present in every case of contusion in the living, cannot be produced by blows upon the dead body. An ecchymosis following an injury received during life, may not make its appearance until some hours after death; or a small bruised patch, seen during life, may increase in size after death. A contusion received some hours or days before death, may often be recognized as an injury of some duration by the changes which have taken place in its color, the borders of the ecchymosed patch having become lighter and faded, and portions of the bruise looking greenish or yellow. It is well to recollect, in medico-legal investigations, that a severe blow is not always followed by visible discoloration. The injury may have been sufficient to cause death, and yet no mark of violence may be seen on the skin or subjacent tissues. It should also be remembered that a very slight contusion, causing little or no pain, may produce extensive ecchymosis in purpuric individuals, or in " bleeders," or in persons who have a large quantity of subcutaneous fat.

DISCOLORATION often makes its appearance in a few moments after the injury has been inflicted. Sometimes, however, several days pass before it is seen, and when this is the case it indicates a deep-seated lesion. After fractures, discoloration is frequently not seen until two or three days have elapsed. The ecchymosis may reach its full extent in a few minutes, extravasation of blood and exudation of bloody serum ceasing soon after the blow; or it may go on for several days, gradually extending for some distance under the skin. The discoloration at first may be black, or a deep purplish-blue, or, in some cases, pink or crimson. Blackness usually indicates a severe injury and extravasation of pure blood; various shades of purple or blue are produced when blood is mixed in different proportions with blood-stained serum; a pink or crimson hue shows that the ecchymosis is superficial, and that oxygen from the atmosphere is admitted through the thin epidermis or mucous covering of the part. We see examples of the latter condition in ecchymosis of the eye, where the crimson color contrasts strongly with the deep blue or black bruise of the lids and surrounding soft parts, after injuries in that region; and in the pink or red color of a superficial blood-blister just below the epidermis; when the contusion is more deeply seated, the blister is black. The discoloration changes in ordinary cases after the lapse of one or two days. Gradually it becomes lighter, changing from black, or blue, to an olive-brown; then to a greenish-yellow; and finally to a lemon hue, after which it disappears. These changes in color are probably due to the influence of air and light upon the extravasated material, as in deeper parts—among the muscles for instance—the shade of color is always that of either venous or arterial blood, or of a mixture of these fluids.

Vesicles or *blebs* filled with bloody serum not unfrequently follow bruises, and, when the discoloration is black or purple, the appearance of the part resembles that of gangrene. The phlyctenæ of mortification, however, are filled with putrid serum; and as the scarf skin is detached for some distance around

the bleb, the serum can be made, by slight pressure, to move about from one point to another. This is not the case with the vesicles of a bruise. The latter are also attended by pain and heat; those of gangrene by an absence of both heat and sensibility. In gangrene an offensive odor, and crepitation from the presence of gases, may also be observed.

Absorption or Organization of Extravasated Substances.

When the contusion is simple, and not followed by much inflammation, the extravasated fluids are soon *absorbed*, and the parts restored so fully to their original healthy condition that no evidence of injury can be found. This is sometimes the case in the contusions which attend severe fractures, the absorbents gradually taking up the deposit, which eventually is carried out of the body by some of its emunctories. The fluid portion of the extravasation is rapidly absorbed; the coagulated portion more slowly. When, however, the injury is severe; or when it occurs in an individual whose health is impaired by some vice of constitution, the effusion of blood and bloody serum may remain for many weeks, or even months, unchanged. It may continue liquid, or may become solid, or may be partly solid and partly fluid. When the laceration is severe, and blood collects in a cavity, the effusion is called, as has been said, a blood tumor or hæmatoma. The walls of this cavity are formed of blood-clot, and condensed, cellular and other tissue. The tumor is thus circumscribed, having its boundaries well defined. We find such accumulations frequently accompanying contusions of the back, nates, and loins, and in other places where the cellular tissue is abundant. When the blood remains for some time unabsorbed, its presence causes adhesive inflammation, which closes the cells of the tissues around the deposit, and a thin layer of plastic matter is thrown out, which becomes organized and which is eventually lined by a layer of secreting cells. The walls of an old hæmatoma look very much like those of a thin-walled cyst or abscess. The diagnosis between blood tumor and abscess, or malignant disease, is not always easy. The affections may usually be distinguished by the history of the case —the hæmatoma coming on soon after contusion—and by the absence of signs of inflammation and engorgement of the parts around the swelling; and, if necessary, by use of the exploring needle and by microscopic examination of the contents of the swelling.

The question whether blood extravasated in a contusion can be *organized* and become the nidus of a new growth, is an important and interesting one. John Hunter[1] declared that he had reason "to believe that the coagulum has the power, under necessary circumstances, to form vessels in and of itself," and this theory was practically accepted by Sir Astley Cooper and others of that day. Sir James Paget[2] says: "There is sufficient reason to believe that blood extravasated in a contusion may be organized;" but he adds, "Nevertheless, it is not probable that this organizing of blood is frequent after contusions; and the more exact the researches that are made, the less reason is there found to adopt the belief that blood extravasated in a contusion can become a tumor of any kind." Rindfleisch says that the process of organization is effected by leucocytes which come from the tissues in the neighborhood of the clot, and not from the clot itself. It seems not at all improbable that the new growth has its origin, not in the clot, but in some plastic deposit left there by inflammation originally set up by the force which

[1] Treatise on the Blood, etc. Works (edited by J. F. Palmer), vol. iii. p. 119. London, 1835.
[2] Article on Contusions. Holmes's System of Surgery, Second edition, vol. i. p. 623. London, 1869.

produced the contusion; or possibly caused by the mere presence of the blood itself. Whatever the process may be—and it is certainly an obscure one—the fact that tumors, benign and malignant, follow severe contusions, is in accordance with the experience of many observant practitioners of surgery.

PROGNOSIS OF CONTUSIONS.

Unless the parts involved in contusions are important to life, or the injury is extensive, or the patient old or unhealthy, recovery usually takes place, and the parts are completely restored to their original condition. The prognosis, however, is not always favorable. If an internal organ, such as the liver, kidney, or bowel, be involved, the result may be quickly fatal. Contusion of the prostate gland, in the operation for stone in the bladder, is not an uncommon cause of death after lithotomy and lithotrity. In old people, or those of unsound health, a bruise may be followed by inflammation, suppuration, and sloughing, attended by great suffering and danger; or the effused blood may become decomposed, and the case end in septicæmia from absorption of the poisonous fluids and gases thus generated.

When the injury is severe and the ecchymosis extensive, contusion frequently terminates in *abscess*. The blood acts as a foreign body, leading to irritation and inflammation, which continue until suppuration, ulceration, and not unfrequently sloughing, take place. The discharge at first consists of decomposed blood, mixed with pus and the *débris* of tissue, but after a short time becomes like that of an ordinary acute abscess. Suppuration is most apt to follow contusions in feeble and unhealthy individuals, or in cases in which a breach of continuity in the skin has allowed the admission of air to the blood deposit. In persons whose constitution has been impaired by intemperance, scurvy, anæmia, or other cause, severe bruises are apt to terminate in suppuration of a diffuse character.

If, together with the contusion of the superficial tissues, some larger joint be involved, bloodvessels or nerves be ruptured, or bones be broken, the prognosis, is, of course, unfavorable. Contusions involving the periosteum are sometimes followed by permanent induration and thickening of that membrane, attended by great tenderness and pain. Sometimes the site of a bruise remains very sensitive for months without apparent induration or enlargement of the part. In such a case it is probable that some nerve has been injured. When the trunk of a nerve has been ruptured, or its fibres crushed, paralysis of the muscles to which it is distributed results, or the site of the injury may become the seat of severe and persistent pain, often neuralgic in character. Contusions occurring in people who have a rheumatic, or, still more, a gouty diathesis, produce much pain and trouble. A blow or fall upon the foot or hand, which would scarcely be noticed in a healthy subject, often provokes severe and prolonged suffering in an individual subject to gout or rheumatism. The same may be said of persons suffering from syphilis or scrofula. Contusions of periosteum or bone in such patients often end in active inflammation and its consequences.

TREATMENT OF CONTUSIONS.

Slight bruises get well of themselves, and require no treatment. When the injury is severe, the first indication is to stop further extravasation of blood. Arrest of bleeding may have occurred spontaneously, before the arrival of the surgeon. If it has not, the best means of preventing further effusion are *elevation* of the part, *rest*, and the application of *cold*. In simple

cases, cold water, or lotions containing spirit of camphor, tincture of arnica, or the hydrochlorate of ammonium, answer a good purpose. Three or four thicknesses of old linen or cotton cloth should be saturated with one of these lotions, and applied to the contused part. The cloth should be kept constantly wet. One of the best applications I have tried in such cases is a mixture of equal parts of whiskey and water. Lotions containing sugar of lead, sulphate of zinc, carbolic acid, acetic acid, vinegar, alum, or common salt, are also used. These applications not only prevent further effusion, but, acting as sorbefacients, encourage the absorbents to take up the blood and serum which has been poured out. Tincture of bryony has long been the favorite local application among pugilists for contusions received in their encounters. It is still used by these people, and is probably more efficacious than the profession generally supposes.

If some one of the larger vessels has been ruptured, and the subcutaneous hemorrhage threatens to be serious, pounded ice, in bladders or rubber bags, should be kept applied to the part. The effect of ice used in this way should be carefully watched, as the vitality of the injured portion is already low, and the depressing effect of cold carried too far may provoke sloughing which otherwise would not occur. In some contusions of the limbs, when the bones have been broken, joints involved, or important vessels injured, but when it is thought that the limb may be saved from amputation, cold, applied by suspending over the injured part a basket filled with ice, is a valuable agent in limiting and controlling inflammation. The contused limb should be laid in a simple fracture-box, the bottom of which is covered with a layer of bran from one to two inches in depth, or, which is better, fine sawdust; this should also be gently packed along the sides of the limb to give support to the broken bones. The limb should be carefully watched, and the basket of ice elevated or lowered, as the condition of the part may demand. This can be effected by attaching to the basket a cord, which should run through a pulley suspended from the ceiling, or any other convenient point. The injured part receives the dripping from the basket, and is kept continually bathed in the cold air which descends from the melting ice. The application of cold by any of the plans suggested prevents further extravasation, and limits the inflammation which, in severe cases, is sure to follow to a greater or less extent.

In aggravated cases of contusion, when the effusion is very great, the circulation feeble, the temperature low, and the vitality of the part endangered, *dry and warm applications* are demanded. The contused part should then be surrounded with flannel or raw cotton, and this covered with oiled silk. Dry is better here than moist heat. After the extravasation has been arrested, and when the danger from inflammation has passed away, *compression* very gently applied by means of a bandage is often useful. It gives a comforting support to the part, relieves pain, and stimulates the absorbents to take up the effused liquids. In slight cases compression may be used with advantage from the first. The formation of a "bump" on a child's head after a fall or blow on the forehead, is frequently prevented by the mother's pressing the spot with a piece of ice or the handle of a spoon. The pressure arrests the subcutaneous hemorrhage, and diffuses the blood already poured out into the surrounding tissues, whence it can more readily be absorbed. Upon the same principle, when absorption is slow, and when there are no symptoms of inflammation present, rubbing and kneading the part hastens the process of cure.

Writers on surgery generally teach that no attempt should be made to draw off the extravasated blood unless symptoms of suppuration are present. If

air be admitted, we are told, decomposition of the blood will take place, and putrefactive suppuration will be set up. To this rule, however, there will be found exceptions. I have, with a common hypodermic syringe, tapped the soft bag of blood which follows contusions of the face, and have thus drawn off by aspiration the greater portion of the effused fluid without the slightest bad consequences. On the contrary, the cures have been more rapid, and the time during which the sufferer has been confined to his room because of a black eye, materially lessened. A common practice among pugilists is to make an opening in the bruised and swollen eyelid and gently press out the blood, and afterwards to apply a cold compress. When it is important to get rid of the ecchymosis quickly, there is no reason why the needle should not be inserted at several points, if entire evacuation cannot be effected by one insertion.

When the extravasated blood is making injurious pressure on important parts, or giving rise to great pain, it should be evacuated in some way. Contusion of the ends of the fingers or toes sometimes produces extravasation of blood under the nails. The pressure upon the delicate and sensitive structures in this locality occasionally gives rise to great pain, which only the evacuation of the blood can relieve. If the toe or finger be immersed in hot water for half an hour or longer, the nail will be so softened that an opening can easily be made through it, and some of the blood permitted to escape. The application of leeches to ecchymoses, so frequently resorted to with the view of drawing out the extravasated blood, should never be attempted. These fastidious little creatures will never drink from the " stagnant pool when they can get at a running stream." They not only do no good as far as getting rid of the " bruised blood" is concerned, but their bites produce irritation, and increase the probability of suppuration. They should be employed only when it is necessary to subdue high inflammatory reaction, which often follows injuries of this character, and then they should be applied at some distance from the bruised spot.

When the contused part becomes hot, red, painful, and throbbing, and suppuration threatens or is actually present, a free, dependent incision should be made, and the blood and serum thoroughly evacuated. The cavity left should be washed out with warm water containing hydrate of chloral or carbolic acid ; and, after the bleeding has ceased, a light linseed-meal poultice should be applied. Afterwards, every means should be used to encourage granulation and to promote the closure of the wound. A compress and bandage to keep the walls of the cavity in contact, will hasten the reunion of the parts. If at any time during the course of a contusion, a slough forms, its separation should be encouraged by means of a poultice, and the part, as well as the room, bed, and patient's clothes, deodorized and disinfected by some of the numerous agents employed for this purpose. The best are probably the hydrate of chloral, carbolic acid, the permanganate of potassium, and chlorinated soda. When the contusion is complicated by the rupture of a large artery and the formation of a diffused aneurism, a free incision should be made, and both ends of the vessel searched for and tied. When the soft parts are mashed or " pulpefied," the bones comminuted, the large bloodvessels or nerves ruptured, or the joints opened—the circulation being feeble and the temperature lowered—amputation to prevent gangrene will be necessary.

CONSTITUTIONAL TREATMENT.—In the earlier stages of a contusion, when absorption of the extravasated blood is being sought for, a low diet should be enjoined, and antiphlogistic treatment generally should be practised. Absorption of the effusion may sometimes be hastened by free purging. When sup-

puration or sloughing has taken place, the patient will need a supporting treatment, and iron, quinine, and nutritious food should be given. At all times, when suffering is great, opium or some other anodyne should be administered, to allay pain and produce sleep. Contusions of internal organs are usually serious and dangerous injuries, the symptoms and treatment of which will be considered in other portions of the work.

STRANGULATION OF PARTS.

When a cord or tourniquet tightly encircles a portion of the body, cutting off all circulation through the bloodvessels, the part below the seat of constriction dies. Surgeons frequently employ this method of strangulation in getting rid of hemorrhoids, vascular tumors, etc. It is not necessary, however, in order to kill the part, that the cord should be tight enough to cut off all circulation; if it simply interferes with it, greatly lessening the arterial supply or preventing venous return, death of the part may equally follow, but it is effected by a slower and more painful process. The cases which come under the observation of the surgeon are generally those of partial constriction, as where a ring has been accidentally slipped over the wrong finger, which it encircles too tightly; or where a bandage has been unskilfully applied to a limb; or, as in hernia, where the bowel escapes through a small opening in the abdominal wall, and strangulation of the intestine is the consequence. The first effect of this partial constriction is accumulation of venous blood in the vessels of the part, and effusion of the watery portions of the blood into the surrounding parenchyma. At first the part looks glossy and œdematous; obstruction to venous return continuing, inflammation sets in; the vessels become still more over-distended; complete stagnation of blood takes place; vitality ceases; and gangrene ensues. The part changes its appearance, becoming mottled, purplish, and finally black in color.

Tying a string around the penis, as has been stupidly done by nurses to prevent children from wetting their beds, or slipping a ring over the penis, has frequently caused mortification of the organ, and sometimes the death of the patient.

TREATMENT OF STRANGULATION.—The treatment is of course to remove the source of constriction as soon as possible. A grooved director can generally be passed under a ring, and by means of a file or cutting-pliers this can be divided and removed. Contracting the penis or finger by the application of ice, will sometimes enable the surgeon to get the ring off; or by wrapping a silk thread tightly around the finger from its point to the ring, slipping the free end of the thread under the ring by means of a needle, and then slowly unwrapping the cord, the ring will be made to follow.

BRUSH-BURN.

Mr. Erichsen has employed this name for a peculiar kind of contused wound, made by severe friction of some portion of the surface of the body. It is frequently caused by the belting or other parts of machinery in rapid motion, coming in contact with the body; or by a rope, which an individual is holding, passing with great velocity through his closed hand. I have seen an extensive "brush-burn" produced on the buttocks and back of a boy, who slipped from his sled while sliding or "coasting" rapidly down a steep hill

covered with ice and snow. Heat is developed by the friction, and the integument is abraded, and in severe cases the subcutaneous tissues are more or less contused.

TREATMENT.—The injured part should be protected from the air, as in the case of an ordinary burn. The separation of sloughs, if formed, should be encouraged by the use of water dressing or poultices, and the resulting sores treated on general principles. Repair will be effected by granulation.

WOUNDS.

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From a clinical point of view, wounds may be divided into the "open" and the "subcutaneous," if we exclude those by which animal poisons are introduced into the system, such as dissection wounds, the stings of insects, bites of snakes and rabid animals, and the wounds which afford an entrance to the poisons of glanders, malignant pustule, and, last but not least, syphilis. The term *open* is applied to all injuries caused by external violence—the result either of accident, or, as in operation, of design—in which there is a solution of continuity in the soft tissues, and in which the deeper parts are exposed to the influence of the air, through a more or less gaping orifice. The term *subcutaneous* is applied to such injuries as follow external violence, and in which the deeper tissues, bones, or viscera, are broken, ruptured, lacerated, or crushed, without any breach in the continuity of the soft parts covering them, and consequently without their exposure to the influence of the external air, as well as to such operations as may be done by the surgeon through a small external or open wound—as in tenotomy, myotomy, and osteotomy. *Open* wounds are more serious as a rule than the *subcutaneous*, though when large vessels and viscera are concerned, the latter are among the gravest injuries the surgeon has to deal with. Open wounds, moreover, heal by a more complicated process than the subcutaneous, and are exposed to risks from which the latter are free.

CLASSIFICATION OF OPEN WOUNDS.

When made by a sharp-edged instrument, either by accident or in an operation, wounds are said to be *incised;* when inflicted by a blunt instrument that tears, they are called *lacerated;* and when caused by one that bruises, *contused.* Wounds caused by the thrust of a pointed instrument are called *punctured*, though when the weapon is sharp, the tissues are simply pierced and cut deeply; but when blunt, irregular in shape, or increasing in diameter from the point towards the handle, the soft parts are forced asunder as by a wedge, and are consequently stretched and contused. A punctured wound thus under some circumstances approaches the character of the incised, and under other circumstances that of the contused form of injury. As a matter of fact, however, all wounds of soft parts are more or less contused, those inflicted with a very sharp instrument being, of course, the least so.

A wound is called "simple," when it has been made by a clean, sharp-edged instrument, in a healthy subject, and when there is nothing in the nature of the wound itself, or in the state of the patient, to prevent or retard repair, provided that the injured part be placed in a favorable position for the repara-

tive process to be carried out. The wound is called "complicated," when there are foreign bodies lodged in the part to interfere with repair; when it is attended with hemorrhage, or with much contusion or laceration of tissue; or when from the peculiarity of the patient there are nervous symptoms, severe pain, constitutional disturbance, or local inflammation; or when repair is interfered with by the presence of such complications as bad health or old age.

INCISED WOUNDS.

Open incised wounds are best seen as the result of operations, but they may also be well studied as clean cuts, accidentally made with sharp-edged instruments. They may *gape* from the elasticity or contractility of the tissues divided; may *bleed* from the division or wound of small or large vessels; and may give rise to variable degrees of *pain*, according to the number or character of the nerves involved, and according to the susceptibility of the patient.

GAPING OF INCISED WOUNDS.—The amount of *gaping* in a wound varies with the tissue divided. *Skin*, which is the most elastic tissue in the body, retracts when divided far more than other tissues, and transverse wounds of skin gape more than those which are longitudinal. *Arteries*, when wounded transversely or obliquely, gape much, and when completely divided across, retract far into the tissues. Divided *veins* retract less than arteries. *Muscles*, when their fibres are cut across, shorten rapidly by contraction, and thus aid the gaping of a wound. *Fibrous tissues* and *nerves*, when divided, retract but little. All wounds, however, which are made in parts in a state of tension, gape much, and tissues which are on the stretch when divided, retract far more than they would do if they were relaxed. Thus an incision made into the full breast of a suckling woman, will probably by gaping appear as wide as it is long; while one made into the same organ in a flaccid state, would gape but little. Some tissues, on the other hand, never gape on division; this is best seen in wounds of the palm of the hand, and of the sole of the foot.

The surgeon takes advantage of these known conditions of gaping and retraction of tissues, and in his operations so places on the stretch the parts to be divided, as to enable him to make a clean and decisive section of the tissues with which he is dealing—a single sweep of the knife, made under these circumstances, doing the work of many when made under others less favorable.

HEMORRHAGE FROM INCISED WOUNDS.—The *bleeding* that attends an incised wound depends principally upon the size, number, and character of the vessels that are divided, although it may be influenced by the personal peculiarities of the patient, and more particularly by the fact of his being a "bleeder," or not; or, in other words, by his being, or not being, a subject of the "hemorrhagic diathesis." The condition of the wounded part, moreover, whether inflamed, or otherwise more than normally supplied with blood, has some influence; and the effects of position must always be taken into account. Putting aside, however, these peculiarities, constitutional and local, the myriads of vessels that are divided in a wound made in a healthy subject with sound tissues, rapidly if not instantaneously close on the removal of the dividing medium; for it is a fact that capillary bleeding after an incised wound rapidly ceases by natural processes, and that what goes by the name of "hemorrhage" is due to the issue of blood from wounded arteries of some size, or from wounded veins, the bleeding, if it does not prove rapidly fatal, persisting till nature's hæmostatic processes—unassisted or assisted by art— have had time to act.

PAIN OF INCISED WOUNDS.—The *pain* attending an incised wound varies in its nature and degree, according to the position of the wound and the tissue wounded. Some portions of the body, such as the skin of the face and fingers, orifices of the mucous tracts, periosteum, or tense tendons, are far more sensitive than the skin of the back or buttocks, the bones, and the fasciæ. The sensibility of the patient has likewise much to do with the degree of pain experienced, as has the condition of the nervous system at the time at which the wound is received. Not only may one subject of an operation be far more sensitive than another, but the same person may feel pain more acutely at one than at another time, the general condition of the physical powers, and more particularly of the nervous system, greatly influencing sensibility.

Unexpected or unseen wounds, or wounds received during drunkenness, or when the mind is intent on other things, as in the excitement of battle, are often unfelt, or felt but slightly; whereas when the mind of a patient is fixed upon the performance of an operation, the evil influence of anticipation aggravates his suffering.

LOCAL AND CONSTITUTIONAL EFFECTS OF INCISED WOUNDS.

The *local effects* of a simple incised wound, in a healthy subject, may extend little beyond the breach of surface, and the slight pain and bleeding which attend the injury. The *constitutional effects* may be so slight as to be unobserved. In a general way, however, local as well as constitutional effects show themselves, and these are greatly influenced by the extent of the wound, the general condition of the patient, and the treatment to which the injured part and the patient have been subjected.

LOCAL EFFECTS.—The *local effects of a wound* are best studied in a deep, incised cut, which has passed through skin, subcutaneous fat, and fascia. The wound, directly after its infliction, will gape, and, after the lapse of but a brief interval of time, this gaping will increase, so that the subcutaneous fat will appear as if it were being pressed out of its position, and as if the divided edge of true skin were retracting from it, and becoming everted. Within an hour or an hour and a half, the edges of the wound will be seen to be *swollen* and slightly *red*, from increased vascularity, and, where the connective tissue of the wounded part is loose—as in the eyelid or the male genital organs—puffed up and *œdematous*. To the patient, the part will feel hot and stiff, and it will be the seat of a dull, aching, or burning pain. The edges of the wound will also probably be more sensitive, the amount of pain depending much upon the *tension* of the parts, and upon the treatment to which they have been subjected. If the edges of the wound have been stitched together, and the parts are much swollen and œdematous, there will be tension upon the wound, and a disposition to separate and gape. In a healthy subject, however, when repair goes on well, all these local phenomena will subside and disappear in the course of two, three, or four days, according to the rapidity and perfection of the healing process, and a cure will then take place. But should the local phenomena above described be more persistent, increase in severity, spread beyond the margins of the wound into surrounding parts, or alter in character for the worse, what has been a physiological, reparative process will pass into a pathological or diseased one, and the parts will then be said to be "inflamed."[1]

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[1] See vol. i. p. 65.

CONSTITUTIONAL EFFECTS.—The *constitutional phenomena* associated with these local changes, vary greatly. In some subjects, a trivial, local injury, a mere cut, may give rise to severe shock, or to a disturbance of the nervous system which expresses itself in convulsions; whereas in another, a severe and extensive wound may be followed by few if any constitutional symptoms.

Shock.—The gradations of *shock* and *collapse* are innumerable, and the symptoms by which they are characterized vary from a passing faintness or disturbance of the heart's action, to fatal syncope. The state of collapse may be regarded as a chronic syncope. Patients may unquestionably die from shock following slight injuries or minor operations, though no satisfactory cause for death may subsequently be discovered, the heart's action in these cases being suddenly stopped through some central nervous influence. The degree of shock that attends an accident or operation depends as a rule, however, upon the importance of the injured organ in the animal economy, the extent and nature of the violence which the tissues have sustained, the size of the bloodvessels which have been involved, and the amount of blood which has been lost.

A patient, in good general health, will bear a severe wound or operation with little shock, while another with diseased viscera, and more particularly with diseased kidneys, will be subjected to severe shock from even a trivial injury. The age and constitutional condition of the patient have an important influence under all circumstances.

Reaction.—When what has been described as the period of "shock" after an accidental or operative wound, has passed away, the stage of "reaction" is reached, and in a general sense it may be assumed that the intensity of this stage is fairly governed by the intensity of that which preceded it. That is to say, where there has been little shock, there will be but feeble reaction; and where the shock has been severe or prolonged, the stage of reaction will be of a like type. Still this rule has innumerable exceptions, and these exceptions seem to depend more on the individual peculiarities of the patient than upon anything else: one person, after a slight injury or operation, experiences little shock, but sharp reaction; while another, suffering from a severe injury or operation, will have a prolonged stage of shock, followed by no more reaction than seems to be necessary to restore the circulation to its normal condition, and to allow the functions of the body to work efficiently. Children and women, and the subjects of neurotic tendencies, always react rapidly and in a marked way from all kinds of shock, whether mental or physical, but at the same time these subjects, as a rule, do well. The rigors, nervous tremblings, and fears, which are often met with in nervous subjects after operations, and which often cause alarm, are but rarely followed by any bad results.

The symptoms of reaction, in their mildest expression, are simply those of the restoration of the nervous and circulatory functions to their normal condition—the heart, with the circulation generally, so rallying from the depressed condition into which it has been thrown by the "shock" of the accident or operation, as to come up to the usual standard of health; and the nervous system so recovering from the temporary state of depression, if not of unconsciousness, into which it has been cast, as to resume its normal power of governing and controlling the actions of the body over which it presides. The reparative process consequently, under these circumstances, may be expected to go on uninterruptedly to a successful issue; the wound will undergo repair, and heal, and the subject of the wound will suffer little or no constitutional evil beyond that occasioned directly by the injury. The

stage of reaction, in a clinical sense, will then be normal; it will be such as may be said fairly to balance that of shock, and to tend towards recovery.

Traumatic Fever.—When the symptoms of reaction, either with respect to intensity or duration, exceed this normal standard; when the circulatory system acts powerfully and rapidly, the respirations increase in quickness, the brain and special senses become abnormally active, and the temperature of the body rises, and remains above that of health ; and when, with this elevation of temperature, the functions of the body generally are disturbed and work badly, as indicated by thirst, a foul tongue, loss of appetite, constipation, diminished secretion of urine, want of sleep, or disturbed rest—*traumatic fever* is said to exist.

This fever may show itself the day after the injury or operation, or may not appear till the second day, and it may last for twenty-four, forty-eight, or even seventy-two hours. When the case is going on satisfactorily towards recovery, the fever seldom lasts beyond this period. Should the symptoms, however, continue, dangers are to be apprehended, and difficulties looked for. When the fever runs on into the fifth or sixth day, the surgeon may be sure that some complication is present, and, should the symptoms be still more fixed, the probabilities are that the case is not only badly complicated, but that it will pass on to a fatal issue.[1] Under all circumstances, and in the treatment of every wound, accidental or operative, the eye of the surgeon should be steadily fixed on the temperature chart—such a chart affording the surest indication of the advance or presence of any evil complication.

PROCESS OF REPAIR IN WOUNDS.

Before entering into details, it is well to know, as a primary truth, that the processes of repair are identical in all tissues; that the reparative process in bone or muscle, integument or tendon, soft or hard parts, is the same, such modifications alone showing themselves as necessarily appertain to the anatomy of the tissue or special circumstance of its position. Thus, tissues that are highly vascular, may undergo more rapid and more perfect repair than others less fortunately circumstanced, and bone tissue may require more time to unite than skin, yet in all the process is alike. Let us therefore inquire what the process is, and see what changes take place in parts undergoing repair ; and then look at them where they are best seen, where an incision is made through the skin and the edges are brought together.

IMMEDIATE UNION.—The chief points that can be observed have reference to the capillaries. In these, at the margin of the wound, the blood will be found coagulated up to the nearest anastomosis, and the capillary vessels in the neighborhood will be seen to be dilated—this dilatation being caused by the increase of pressure to which the capillaries have been subjected by the altered circulation of the blood in the immediate vicinity of the wound. When wounds unite by *immediate union* (the "first intention" of Hunter), no other changes than these take place, beyond the gradual restoration of the capillary circulation through the parts that have been divided, and under these somewhat rare circumstances no scar or cicatrix is left. The soft parts at first simply adhere together, and consequently become continuous.

PRIMARY ADHESION.—Should the wound unite by what is called *adhesive union* or *primary adhesion*, in which a cicatrix is formed, other changes are to be

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[1] See a paper by the author, in the Lancet for June 5, 1880.

seen; and these take place in the connective tissue—in which the vessels of the part ramify—a tissue that pervades every other, and which is made up of cell elements and inter-cellular tissue, the cell elements varying according to the nature of the part in which it is found. These changes consist of cell multiplication, and, under the circumstances supposed, we find between the edges of the wound a vast accumulation of cells, filling up in various degrees the spaces of this wounded tissue. It is through these cells that cicatrization takes place, these cells being in part simple nucleated cells, which may be called "embryo cells," with connective-tissue corpuscles containing a nucleus and nucleoli—Klein's "Placoid Cells."[1] (Fig. 200.)

Fig. 200.

A group of placoids in different stages of growth; *a*, embryo cell wandering. (After Golding-Bird.)

Whether this cell multiplication depends upon changes in the cell itself, as Virchow affirms, or whether the cells are the white corpuscles of the blood which have escaped by exudation from the capillaries, as Cohnheim would lead us to believe, I do not now care to inquire. All admit, however, the multiplication of cells in the affected tissues. Professor Redfern writes:[2] "the facts must be recognized; the floating blood-cells are really the very cells which once formed the substance of the lymphatic glands, the spleen, and other organs; and they do, in fact, move through the walls of the blood passages, and wander about freely in what are called solid tissues." When we recollect how penetrable the tissues of an animal are, we shall cease to be startled at seeing those parts become the seat of entirely new deposits, or finding them traversed by migrating blood-corpuscles as freely as a colloid is penetrated by a crystalloid.

CICATRIZATION.—Let us now inquire briefly how cicatrization proceeds, and note that it is in the cells that the most important changes are to be recognized. Those nearest the injured part gradually assume a spindle shape, and the intercellular tissue into which these spindle-shaped cells are infiltrated becomes denser. The spindle-shaped cells then gradually change into ordinary connective-tissue corpuscles, and in this way new cicatricial tissue is formed. (Fig. 201.) This new tissue, however, again undergoes changes—changes of consolidation. The intercellular tissue becomes gradually more condensed— the spindle-shaped cells also assuming the flat shape of connective-tissue corpuscles, and in a measure disappearing, the nucleus often alone remaining— the fluid that existed in the newly formed tissue is absorbed, and the new cicatrix by degrees thus becomes firmer and denser, gradually contracting, so that at last the delicate scar of a large wound becomes solid and compact— the cicatrix in smaller wounds appearing only as a thin, red, and at a later period as a white line.

Changes in the capillaries of the part are, however, going on during all this period, and how far *all* the changes that have been briefly described are due directly to the capillary action, is not yet determined. If Cohnheim's views be adopted, it is to the capillaries that the chief action in the tissues must be ascribed, but if those of other pathologists, such as Virchow and Billroth, be accepted, the capillary action takes a secondary place, and the cell elements

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[1] Figs. 200–204 are taken from a valuable paper written by my friend, Mr. Golding-Bird, and published in Guy's Hospital Reports, 3d s., vol. xxiv (1879).
[2] Address at meeting of British Association, 1874.

Fig. 201.
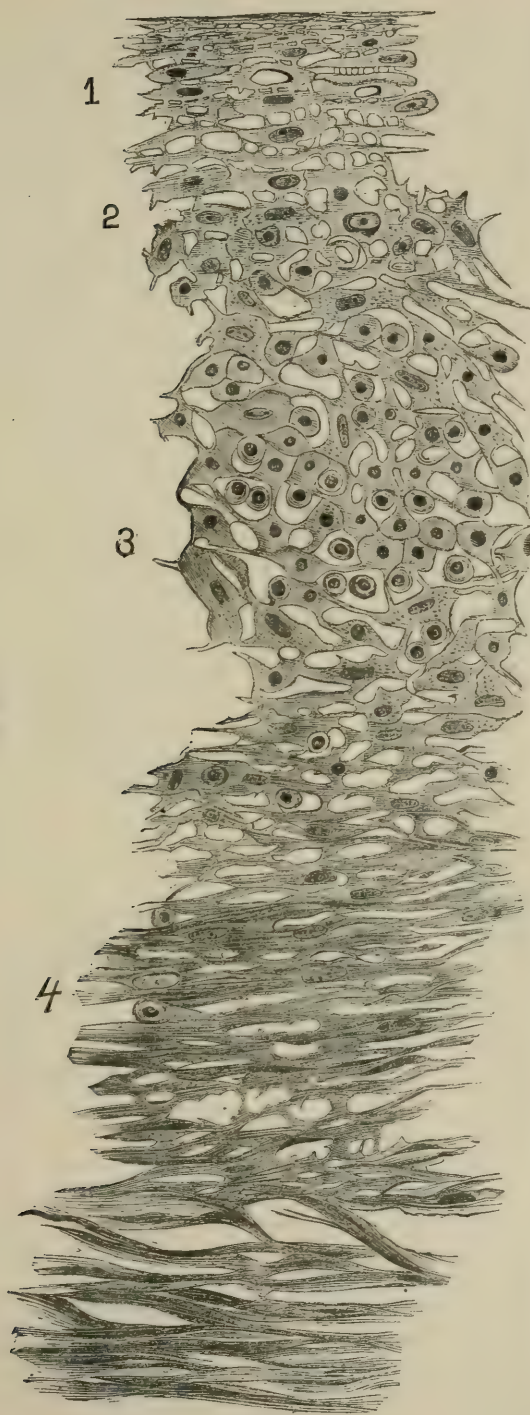
Semi-diagrammatic view of a section through a healing ulcer. 1, Epithelium formed; 2, Placoid cells developing into epithelium; 3, Region of granulation tissue; most of the cells are embryonic and free in the meshes of protoplasm; placoids exist in numbers to form—above, epithelium—and below, fibrous tissue; the cells with a round granular nucleus are transitional; 4, Tissue undergoing cicatrization; it contains but few embryo cells; the protoplasm is arranging itself in transversely elongated meshes above, but below it becomes fibrillated; the placoid nuclei, which appear as dark rods, become the connective-tissue corpuscles of the new fibrous tissue. (After Golding-Bird.)

take the leading one. On either theory, the importance of the capillaries cannot be overlooked.

With regard to the changes in the capillaries, it has been already pointed out that, at the beginning of the reparative process, those of the part become sealed, and the collateral circulation in the neighborhood becomes irregular and pressed upon; and that the coagula in these obliterated capillaries become reabsorbed or possibly reorganized as repair progresses, since it is certain that the capillary network soon becomes continuous through the newly formed cicatricial tissue, and that the capillary meshes of the one side join, by loops projected through the new tissue, similar meshes of the opposite side.

What influence the *nerves* of the part have upon the reparative process, we do not know. That they have an important influence there can be little doubt, since all physiologists recognize their power upon secretion and nutrition; the vaso-motor nerves doubtless have the greater power. But we must learn something more of nerve power generally, and of nerve distribution—something of the way in which the nerves terminate in the tissues, and what relation they bear to the capillaries—before we can hope to find out or understand the exact influence which nerve supply has on repair.

REPAIR BY GRANULATION.—All wounds do not, however, heal by immediate union, or by primary adhesion, and wounds that gape cannot so unite. The process of repair in these, therefore, differs somewhat in its character from the process in those which we have been considering; it takes place by *granulation*, or the "second intention" of Hunter. If we closely examine the surface of a wound thus exposed, we shall find that it becomes, within a few hours of its exposure, covered with a film of a peculiar, gelatinous, grayish-white appearance. This will be seen with the aid of the microscope to be composed of granulation-cells or white blood-cells, Hunter's "plastic lymph." After an

Fig. 202.   Fig. 203.
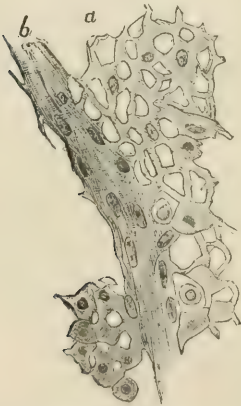
Bloodvessel forming in *a*, granulation tissue; the wall, *b*, forming from placoids and protoplasm. (After Golding-Bird.)
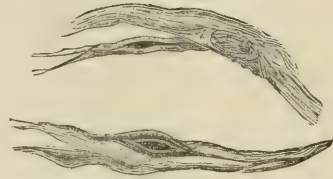
Spindle cells, developed from placoids, from the walls of a forming bloodvessel. (After Golding-Bird.)

interval of some hours, the parts covered with this gelatinous grayish film become more vascular, as indicated by redness, and the surface more even. The film itself assumes a tougher character, and a yellow fluid, which is mixed with small yellow sloughs of fibrinous tissue, is secreted. The wound begins "to clean," and to have a smooth and consistent surface. After the lapse of another day, or some days, perhaps, this surface is covered with a number of elevations, known by the name of *granulations*, varying in size from a millet-

seed to a hemp-seed, the smaller being highly vascular and red, the larger being, as a rule, paler and more bloodless. The wound at this time is "granulating." The secretion from these granulations is now of a creamy-yellow character, and is called *pus*. They are made up of cells called granulation cells, which resemble inflammatory lymph-cells, each granulation being composed of a capillary loop surrounded by simple, nucleated, embryo cells, and by connective-tissue or placoid corpuscles (Figs. 202 and 203). Of the nuclei, Paget says:—

" Some of these nuclei are arranged longitudinally, others transversely, to the axis of the vessels." In the development of these vessels changes occur, answering to those seen in ordinary embryonic development. "Organization makes some progress before ever blood comes to the very substance of the growing part; for the form of cells may be assumed before the granulations become vascular. But for their continuous active growth and development, fresh material from blood, and that brought close to them, is essential. For this, the bloodvessels are formed; and their size and number appear always proportionate to the volume and rapidity of life of the granulations. No instance would show the relation of blood to an actively growing or developing part better than it is shown in one of the vascular loops of a granulation embedded . . . . among the crowd of living cells, and maintaining their continual mutations. Nor is it in any case plainer than in that of granulations, that the supply of blood in a part is proportionate to the activity of its changes, and not to its mere structural development. The vascular loops lie embedded among the simplest primary cells, or, when granulations degenerate, among structures of yet lower organization; and as the structures are developed, and connective tissue formed, so the bloodvessels become less numerous, till the whole of the new material assumes the paleness and low vascularity of a common scar.'"

If at this time, when the granulations have attained to the level of the skin, we look to the margins of the wound, we shall see a dry, red band of newly formed tissue, with an outer border of a bluish-white color, where it comes into contact with sound integument. This band is the new skin forming, and is caused by the gradual growth of the epidermis from the margin of the sound skin towards the centre of the sore. Such a process is called *cicatrization*. The cicatrix is at first red, as in the linear cicatrix to which we have already alluded, but, as it then contracts, it subsequently becomes paler, and more compact and adherent. The nature of the scar or cicatrix varies with the tissue in which it is formed, the new connecting medium or cicatrix under all circumstances having a powerful tendency to adapt itself to the peculiar character of the tissue in which it is placed. Thus, a cicatrix in skin, in time closely resembles true skin; a cicatrix in bone, true bone; and a cicatrix in tendon becomes tough and hard, like tendon; the consolidating, reparative material in every instance partakes of the character of the parts which it connects. It is corpuscular in its origin, and clearly fibrinous in its nature; but whatever the origin may be (though there is considerable divergence of opinion about it), its existence is undoubted, and through it and by it all repair takes place.

Fig. 204.
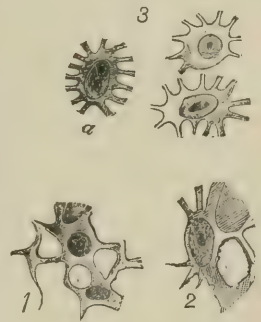
Epithelium developing from granulation cells in the order of the figures 1, 2, 3; No. 3 shows the fully-formed "cog-wheel" cell, at *a*, becoming vacuolated by the loss of its nucleus. (After Golding-Bird.)

SECONDARY ADHESION.—When two granulating surfaces are brought together, and union takes place between them, healing by *secondary adhesion*,

¹ Paget, Lectures on Surgical Pathology, Third edition, page 165. London, 1870.

or by the *third intention*, is said to occur. The process of repair under these circumstances is similar to that of adhesive union, the two layers of granulations adhering in the one case, as the two surfaces of divided tissue do in the other, by means of new material. The capillaries and embryo-cells under both circumstances undergo changes such as have been described. For this form of union to take place, the granulations, however, must be healthy.

REPAIR BY SCABBING.—When wounds heal by *scabbing*, granulations do not form. In this process, the reparative material which is poured out, undergoes at once similar changes to those already described as taking place in adhesive union, and the wound cicatrizes rapidly beneath the scab ; for the serum of the blood, when effused on the surface of a wound, is of a highly plastic character, and quickly coagulates to form a film of a protective nature, under which repair may rapidly proceed, the embryo cells, with this plasma—Hunter's "plastic lymph"—being the medium of repair. Advantage is taken of this fact in the treatment of superficial wounds, the value of felt, cotton-wool, or any similar material, when applied to an open wound, entirely depending upon this plastic property of blood. Repair by scabbing is doubtless the best form of healing, although it is, unfortunately, somewhat rarely obtained.

NATURE OF HEALING PROCESS.

The nature of the healing process is physiological, and resembles closely that of development and growth ; the changes in the cell elements which have been described in repair, and the gradual development of the most elementary tissue into cicatricial tissue or higher structures of the human body, are similar in nature, if not in form, to those which are witnessed in the embryo, when the blastoderm cells in the ovum, or primary nucleated mass of protoplasm, grow, develop, and differentiate into the various structures of the human animal. In both of these processes, there must be pabulum for nourishment, such as the blood, and there must be a sufficient supply of it ; there must likewise be a regulating force to control and direct the formative process, and this force doubtless comes from the nerves. When the vascular supply is deficient, repair, growth, or development must suffer, and the physiological process of repair cannot go on ; when the vascular supply is in excess, what would have been a physiological, becomes a pathological process, and the part undergoing repair after injury is said to be " inflamed." The process of *construction* under these circumstances ceases, and that of *destruction* may ensue ; or there may be other changes in the inflamed and formerly repairing wound or granulating surface, which will be considered on a subsequent page, under the heading of Diseases of Granulations. What I would now impress upon the reader, is, that whatever action is required for the healing process is physiological, and is just equal to its purpose ; when it is excessive, it becomes pathological, and is known as inflammation—inflammation, when it attacks a wound, at first checking repair, subsequently undoing it, and, at a still later period, bringing about disorganizing changes ; inflammation, under all circumstances, having a destructive tendency.

REGENERATION OF TISSUES.

It has already been asserted that the processes of repair are identical in all tissues ; that the reparative process in bone or muscle, integument or tendon,

capillary or nerve, is the same, such modifications alone showing themselves as necessarily appertain to the anatomy of the tissues. It is well that this physiological truth should be fully recognized, but, at the same time, it is to be equally recognized that all tissues are not formed out of cicatricial or connective tissue, and that the higher forms of structure, such as muscle, nerve, bone, etc., are repaired by the regenerating influence of the injured tissue itself, new cells springing or growing by a kind of budding process from the divided ends of the injured part, and the new cells in contact with, or poured out by, the injured tissue, whether as embryo cells, connective-tissue cells, nerve cells, muscle cells, or bone cells, being so influenced by the tissue with which they are in contact, and from which they probably have originated, that they anatomically partake of its nature, and more or less thoroughly bring about its repair.

REPAIR IN MUSCLE.—Thus, when *muscular tissue* is wounded, or more or less destroyed, O. Weber tells us that it may be restored, and that the young muscular fibres are formed out of the old by the division of the protoplasmic material of their extremities, the repair of muscle being thus brought about by agencies closely simulating those of fœtal development, in which the young muscular elements are formed almost entirely out of the cells contained within the old muscular fibres. Gussenbauer even gives a drawing of the process (Fig. 205), but Billroth declares that he has never seen anything which

Fig. 205.
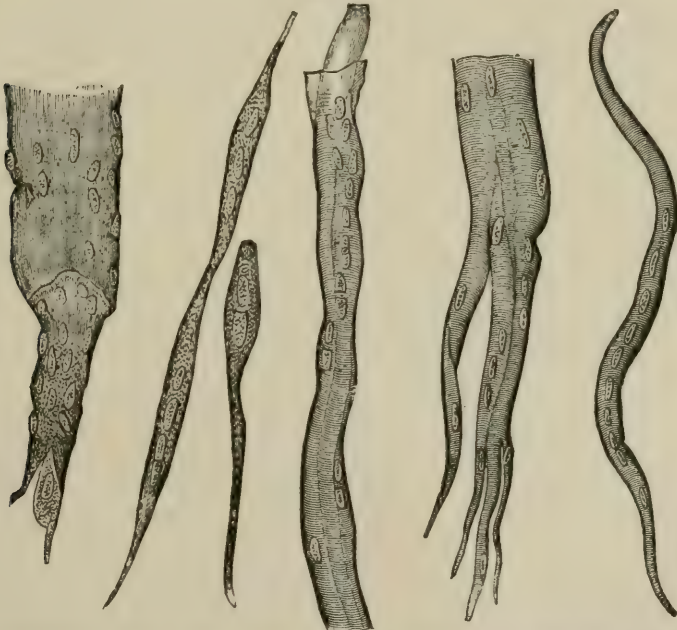
Process of regeneration in striped muscular fibre after injury. Magnified about 500 times. (After Gussenbauer and Billroth.)

he could regard as a re-formation of muscular fibres, and that the cicatrix in muscle is almost entirely connective tissue ; the extremities of the muscular fibres, after division and repair, uniting with the cicatricial tissue in the same way as they do with the tendons. My own observations go to confirm those of Billroth.

REPAIR OF NERVES.—It may with confidence be asserted that an injured or even a divided nerve may be thoroughly repaired, since conclusive evidence has in recent times been adduced to prove that such a large nerve-trunk as the median, the ulnar, or the great sciatic, may be divided and subsequently so joined by surgical skill as to secure, after the lapse of a certain interval of time, perfect union of the divided ends, as proved by the complete restoration

Fig. 206.   Fig. 207.

Regeneration of nerves.

From a rabbit, fifteen days after section ; young spindle cells in the nerve-ends, developed from the connective-tissue, and ultimately connected with the neurilemma. (After Billroth.)

From a frog, ten weeks after section ; development of young nerve cells from spindle cells. Magnified 300 times. (After Hjelt and Billroth.)

of the functions of the nerve in their physiological perfection.[1] It is likewise true that new cicatricial tissues become sensitive, and that parts which, by accident or operation, have been deprived of the influence of one nerve regain their sensibility, either by the growth of new nerves, or by the assumption on the part of another branch of the same nerve, or of another nerve, of the physiological functions of the one that has been destroyed. Hence the conclusion is clear that nerve-tissue must be regenerated, and that the divided ends of nerve must re-unite by new nerve material. It seems, moreover, highly probable that new nerves may be developed. In a physiological point of view, these facts are not only very remarkable, but they tend to demonstrate the perfection of the reparative process, since to allow of the conduction of nerve-force to and from the nerve-centres, very perfect conductors are unquestionably required. The process by which this repair is brought about has been carefully studied by Schiff, Hjelt, and others, and is much after the following fashion, as given by Billroth (Figs. 206, 207):—

" There is, first of all, a degeneration of the medullary sheath, possibly also of the axis cylinder, for a certain distance from the injury, which is quickly followed by the production of cells in the neurilemma; these develop into spindle cells and spread into the tissue which intervenes between the nerve-fibrils, and which extends also between the cut extremities of the nerves. From these cells, as in the embryo, new nerve-fibres are developed," and these new fibres " ultimately cannot be distinguished from ordinary nerve-fibres."[2]

[1] Weir Mitchell, American Journal of the Medical Sciences, April, 1876 ; Hulke, Transactions of the Clinical Society of London, vol. xii.
[2] Billroth, Lectures on Surgical Pathology and Therapeutics, vol. i. p. 152. London, New Sydenham Society, 1877.

Sources of Interference with Healing of Wounds.

The different modes of healing, and the processes by which injured tissues are repaired, having been fully described, I propose to consider next the causes that interfere with, retard, or prevent repair; and these may be found either in the *subject of the wound*, in the *wound itself*, or in *its treatment*.

PRESENCE OF FOREIGN BODIES.—Amongst the causes which pertain to the wound itself, the presence of any *foreign matter* whatever must be placed first, since it is clear that where such is found, even to a very limited extent, repair by immediate, primary, or quick union is impossible; the foreign matter not only, by its presence, mechanically prevents the adhesion of the surfaces between which it is placed, but also acts as an irritant, or as a promoter of septic changes, and thus excites an action in the wound which is not reparative, but inflammatory. The truth of this general rule is not disproved by the fact that, in exceptional cases, foreign bodies become encysted in tissues, and give rise to but little trouble.

HEMORRHAGE.—The occurrence or persistence of *bleeding* in the wound is a second local cause of non-repair, the reparative process not commencing until all bleeding, even capillary oozing, has been arrested. When the hemorrhage is great, this interference may be serious, and even when little, it is enough to retard and prevent the reparative process from being carried out. Blood, if effused to any extent between the sides of a wound, interferes with the reparative process much in the same way as does a foreign body, and forbids all healing by quick or primary adhesion. If effused in very small quantities between the divided surfaces, it may at times possibly change into cicatricial tissue, and form a bond of union between the divided parts; and under other conditions it may become organized, as when poured out on the brain; but, as a rule, the effusion of much blood into a wounded part is a retarder of repair, or a cause of non-repair. When a wound has to heal by granulation, a clot of blood, as a covering, kept aseptic, is beneficial, since it acts as a protector to the surface of the wound, and allows the granulating process to go on uninterruptedly. It has been said that such clots become organized, but it is far more probable that they simply act, as above described, as a protection to surfaces that are granulating.

CONTUSION AND LACERATION.—A *contused or lacerated surface* in a wound is a third local cause of non-repair, and it is well to recognize this important fact, since, with such a condition of parts, the surgeon knows that immediate or primary union of the wound is not to be expected. Under these circumstances, a line of treatment will be indicated, which will be far more likely to be efficient than one based on the hope of obtaining quick repair. When the contusion or laceration is slight, the hope of securing primary union of the divided parts may indeed be entertained, but, under opposite conditions, such a hope would be altogether groundless. The gradations of contusion and laceration between these two extremes are numberless; but it will be wiser for the surgeon to believe—and upon such a belief to act—that in contused and lacerated wounds the prospect of obtaining quick union is slight, than for him to act upon an opposite view, and attempt to obtain, in severe cases, a mode of healing the occurrence of which is improbable, if not impossible.

In a contused or lacerated wound, the surgeon should mentally see dying or dead matter, which, of necessity, must be separated from the living parts

and got rid of, either by molecular disintegration or by a coarser, sloughing process, before the act of healing can rightly be said to begin; and under these circumstances he will at once recognize the futility of entertaining a hope of obtaining the repair of the wound by quick union.

CONSTITUTIONAL CONDITION OF PATIENT.—Of the causes of non-repair which are to be put down to the account of the subject of the wound, *age* is all important, the reparative process in a man on the wrong side of fifty being conducted with less vigor than in one who is on the right side. In the very old, repair is at its lowest mark. The same remarks are applicable to patients who are the subjects of *organic disease*, or of *degenerative changes* in their tissues, and especially to fat and soft-tissued people; the old in years, or in infirmities, not possessing the recuperative powers of the young and vigorous. Under these circumstances, in the case of a wound resulting from accident or operation, in a patient over fifty years of age, or in one in ill health, it would be wrong for a surgeon to expect, or to rely upon securing, a mode of repair which, in a younger or healthier subject, he might reasonably look for; people who are advanced in years, or who are feeble from frailty or disease, particularly visceral disease, have no or an insufficient capital at the bank of health to draw upon. Of all subjects for wounds, whether accidental or operative, the habitual drunkard is the worst.

DEFECTS IN TREATMENT.—Of the causes of non-repair which are to be attributed to treatment, a want of due care in maintaining the injured or wounded part in a state of *rest*, claims the first place, for in such a delicate process as is that of repair, it is plain that in any movement of the injured part, whether in the way of separation of surfaces or manipulation, the process may be interfered with or retarded, or the work already accomplished undone. Indeed, since it is certain that the best and most rapid repair of an injured part takes place when the wounded tissue is kept in an absolutely immovable position, and when the wounded surface is protected from all external influences that can possibly interfere with the physiological, reparative process, it clearly behooves the surgeon to have this great truth always before him, in order that he may adapt his treatment to the requirements of the case before him, and not have to blame himself—on account of some failure in the healing act—for a want of care in maintaining that absolute immobility of the wounded or cut part which is essential for rapid or even good repair. In the treatment of fractures, the evil effects of want of rest and immobility of the broken bones are well exemplified, but it is to be remembered that the same want of rest and immobility is as pernicious in wounds of the soft as in those of the hard parts; in wounds of the surface as in those of the deeper structures. The term "want of rest" is here used in its fullest sense, as want of that thorough immobility of tissue, which is all important for the rapid perfection of the physiological, reparative process.

Again, if the edges of a wound are allowed either to gape, or to have too much tension upon them, repair will be interfered with—the parts, in both cases, from want of care in their adaptation, want of caution in not making due provision for the escape of the redundant fluids (drainage), or from some overaction (inflammation), not being allowed to remain at rest and undergo repair.

Overaction in the vessels of a part which is undergoing repair—that is, inflammation—always has an evil influence. When it shows itself early in the case it prevents repair, and when manifested at a later period it retards the healing process, or even causes retrogression. Indeed, under all circumstances, when the vascular action of a part which is undergoing repair ex-

ceeds what is essential for the steady perfection of the process, the repair of that part is interfered with. Inflammation (to repeat what has been already said) when it attacks a wound, at first checks repair, subsequently undoes it, and, at a still later period, brings about disorganizing changes. Inflammation has, under all circumstances, a destructive tendency.

The student, having learnt how wounded parts heal by nature's processes, and more particularly how simple incised and open wounds are repaired; and having moreover learnt to recognize some of the most important influences which retard, if they do not arrest, repair, will readily understand the more favorable conditions under which repair can be carried out, and, what is more, will at once appreciate the surgical requirements of the case he may have to treat, so that, as a surgeon, he may know when and where to apply his art, how he can help nature in her beneficent action, and how he can best guard against the intrusion of any outside influences that may tell against the steady progress of the reparative process. For it cannot be too strongly asserted, that the best surgeon is the one who best understands natural processes in the repair of parts, and who knows how to use them to the greatest advantage; who recognizes the fact that these natural processes are exact and, when applied to the healing of wounds, undeviating; who knows that if he is to utilize these natural processes to the full, he must bring up his art of curing to nature's line, under the conviction that nature never systematically bends herself, or puts forth her hand, to help the curer; that she never deviates from her path; that if, using Dr. B. W. Richardson's words, " we do not molest her, she goes on, as we say, naturally, towards a cure; if we molest her a very little, she goes on, and the molestation is but little shown; if we molest her vehemently, she still goes on, showing molestation in proportion to disturbance, nature under all circumstances going her own way, caring just as little for ease as for pain, for life as for death."

When a bone is broken, nature will heal it quite irrespectively of the position in which it is placed; when a knuckle of bowel is strangulated, nature will cast it off quite regardless of the effects of such a sloughing act. But the surgeon who knows this, knows moreover that the same natural process will work on where the bone is " set" in a right position, and maintained there by art; and that the sloughing may be avoided when the strangulated bowel is relieved by art from its false position, and placed where it can be best repaired by nature's means.

Treatment of Wounds.

In the treatment of a simple cut, or incised wound, in which there is no dirt or foreign matter to keep the edges of the wound apart, and to act as an irritant or exciter of overaction, and no hemorrhage beyond capillary or venous bleeding which can be arrested by elevation of the part, moderate pressure, or the application of a cold or hot sponge, the surgeon has simply to cleanse the wound, bringing its edges carefully together, and adopt means to keep them so, while at the same time he makes such provision for the protection of the part as may secure it from injury from without or within, and may allow the reparative process which has been described as taking place in primary union to be quietly perfected. In more severe wounds, a similar practice is to be advocated, though more care may be called for in cleansing the wound; more caution required in the arrest of bleeding; and more ingenuity demanded in bringing the edges of the wound together, as well as in so fixing the injured part in position that the patient may be comfortable, while the wound is kept immobile and protected from such injuri-

ous outside influences as would interfere with the healing act. Provision moreover will have to be made for efficient drainage, that is, for the free exit of such sanguineous or serous fluids as are commonly exuded after severe wounds or operations, and the retention of which always proves injurious. Upon each and all of these points a few lines may not be without value.

Cleansing Wounds.—After full examination of a wounded part, and clear knowledge as to the mode of its production, the extent of injury, and the requirements of the case for cure, the wound should be cleansed. This should be effected with all completeness and gentleness, since, on the one hand, everything like a foreign body between the lips of a wound would of necessity prevent quick or primary union, and would in all probability prove injurious to the subsequent progress of the case, while, on the other hand, anything like roughness would be detrimental to the already injured part. To effect this cleansing with gentleness, a stream of water, medicated with some antiseptic, is the best means for the surgeon to employ, and this stream may be brought to bear upon the part by using the irrigating bottle (Fig. 208), or the

Fig. 208.

Irrigating bottle.

irrigating apparatus (Fig. 209). The stream of fluid washes away blood, with all light foreign matter, and what cannot be thus washed away may be removed with fingers or forceps. In gunshot wounds, special forceps and other instruments may be required.

Those who believe atmospheric germs to be the chief cause of inflammation and suppuration, or of most, if not all, the ills to which wounded flesh is heir, will employ the means that are supposed to be capable of destroying such malignant foreign visitors, and for this purpose will use the spray of carbolic acid, one part in forty, or other antiseptic, to kill the germs in the air as they approach the wound, and will dress the wound with the carbolic lotion, carbolic gauze, protective, and waterproofing, according to the directions laid down in the Article on the "Antiseptic Method of Treating Wounds," whereas those who disregard at-

Fig. 209.

Ward carriage with irrigating apparatus for cleansing wounds.

mospheric germs, and yet highly value means for purifying wound surfaces, will use antiseptic irrigation of the wound with a lotion of carbolic acid, 1 to 20; of thymol, 1 to 1000; of chloride of zinc, 20 grains to the ounce (originally used by Mr. C. de Morgan, many years ago); or of iodine, made by adding 20 drops of the tincture to the ounce of water. I have employed the iodine lotion for years, and prefer it to any other. It is always at hand, and is both simple and effectual as a wound cleanser. The lotion may be used warm, and it has the advantage of not only cleansing the wound in the fullest sense of the term—for iodine is an antiseptic—but it has a marked tendency to arrest all capillary bleeding or oozing. I use it in about the proportions given above, but the best practical guide is to pour the tincture into a basin full of water, so as to make the latter of a light sherry color.

ARREST OF BLEEDING.—It is well that all hemorrhage should be effectually arrested by some of the various means which the surgeon has at his command, before the edges of a wound are brought together; and it is wise to have even capillary oozing stopped, when it is possible, for blood effused in even limited quantities between the surfaces of an incised wound is to be regarded much in the light of a foreign body, and as forming an obstacle to repair, more particularly when primary union of the wound is to be sought for. Indeed, it was on this account that I was first led to employ, for cleansing wounds, the iodine water to which I have drawn attention, and which I cannot too strongly recommend for general adoption. A sponge wrung out of this lotion (made with hot water), and held to a wound for a minute, completely checks all oozing of blood, and tends more than anything else, except prolonged exposure to the atmosphere, to the formation of that glaze upon the surface of the wound, which so much conduces to satisfactory repair.

ON THE QUESTION OF REPAIR BY PRIMARY OR SECONDARY ADHESION.

When the surgeon has cleansed the wound, removed what foreign bodies may have been present, and stopped all bleeding, he has to decide upon the means whereby the reparative process may be best helped, and, as a primary point, to determine either the feasibility or expediency of attempting to obtain *quick* or *primary union* of the cut parts, or the wisdom of looking to their repair by the slower *open, granulating process.*

When the wound is of the *incised* kind, the question is not difficult to answer; for it may with confidence be asserted that, with but few exceptions, in all wounds of this description, whether superficial or deep, accidental, or the result of operation, repair by quick or primary union is to be desired, and, what is more, may be expected, if the subject of the wound be healthy, and not too old, and if nature's reparative process be so aided by surgical art as to be allowed to take its course without interference.

The cleaner the cut is, the greater is the probability of its uniting by quick repair; the more ragged, contused, and lacerated the margins of the wound are, the less are the prospects of obtaining primary union, and the less the wisdom of making the attempt; between these two extremes are innumerable gradations. When there is a doubt about the wisdom of making the attempt to secure primary union, in deep contused and lacerated wounds, let the decision be against it, and when the doubt applies to the more superficial or hopeful class of wounds, let it be decided in its favor.

Care must, however, be taken in these, as in all cases, to give up the attempt on the appearance of the slightest local or constitutional symptom, suggesting that, by the drawing together of the parts by sutures, etc., some

retained blood, serum, or sloughing, injured tissue is keeping the part in a state of *unrest* by tending to separate the lips of the wound, and by exciting tension ; or is undergoing chemical change and decomposition, thus threatening the production of some septicæmic or pyæmic blood-condition. For it must be recognized that, whilst in the cleanest incised wound there may be no death of the divided tissues, and consequently no animal matter to undergo chemical change or putrefactive decomposition ; in the contused and lacerated, there must of necessity be more or less destruction. When tissue dies, it must be shed or cast off from the living parts, before the physiological reparative or uniting process can take its course. When this dead tissue has been separated from the living, it ceases at once to be influenced by the vital processes by which it had been built up, kept alive, and eventually cast off ; it consequently becomes subject to the physical laws of all dead matter, and undergoes chemical changes—which mean too often decomposition.

The object of the surgeon, therefore, in the treatment of these cases of wound in which the death of tissue is to be expected, and cannot be prevented, is to neutralize as far as possible the evil influence of its death and probable decomposition ; and this is to be achieved by so dealing with the injured part that the dead tissue may find a free outlet for its discharge, by rejecting all such applications or dressings as are likely to help putrefactive decomposition, and by employing such means and agents as are likely to neutralize its pernicious influence, and in a measure control the process of decay. With these views, therefore, the surgeon should close up such wounds alone as from their cleanness can be expected to heal by quick or primary union, and should leave open all such as from their raggedness and contusion are sure to be attended with more or less death of tissue, providing in these a free vent for all discharges of decomposed material, and employing antiseptic and disinfecting local applications to neutralize the evils of the chemical changes.

Treatment to help Quick or Primary Union.

To promote the primary union of a wound the surgeon has six indications to follow :—

I. To cleanse the wound ;

II. To arrest all bleeding ;

III. To effect coaptation of the two divided surfaces of the wound—the deep parts as well as the edges.

IV. To maintain the wounded parts in a position of immobility, beneficial to the natural process of repair as well as comfortable to the patient.

V. To secure drainage of the wound by providing for the escape of such dead tissue as may be thrown off, as well as of all fluids that are not required for repair.

VI. To protect the external wound from all such outside influences as may be prejudicial.

The first two indications have been already considered, viz., the cleansing of the wound and the arrest of bleeding. In all forms of wound, and for every form of healing, attention to these points is most important, but when quick or primary union is to be expected, it is all essential.

COAPTATION OF WOUND.—The coaptation of the two divided surfaces of the wound (the third indication), may be efficiently carried out in superficial or not deep wounds by means of sutures and adhesive plaster separately or

combined. When by the use of trustworthy adhesive plaster the object sought for can be obtained, sutures are not called for ; and when sutures are used, the form of suture that carries out the object in view in the simplest way is the best.

Interrupted Suture.—When the wound is *superficial,* the sutures need not be introduced deeply ; but when the wound is *deep,* the practice of bringing the edges of the wound and not the deeper parts together, is fraught with danger, since the repair by primary union which is looked for cannot take place, and between the separated surfaces of the deeper parts of the wound, blood, serum, or inflammatory fluids will collect and give rise to trouble. Hence in deep wounds the sutures should either be all introduced deeply, or deep as well as superficial sutures should be employed. The *interrupted* is the most useful form of suture (Fig. 210), and it is applicable to superficial as well as to deep wounds. In the superficial, it should be inserted with sufficient depth and closeness to bring the surfaces and edges of the part accurately and closely together, and it should be tied with enough force to carry out these objects, but not with more ; since to tie a suture as a surgeon would a ligature, is to do harm—the suture cutting rapidly through the strangulated tissues, and in so doing irritating the part instead of helping repair.

In *deep* wounds the sutures must be inserted deeply, as in harelip operations, and introduced well away from the edges of the separated tissues, so that when they are tightened the deeper parts as

Fig. 210.

Interrupted suture.

well as the superficial will be brought effectually into apposition. In some cases deep and superficial sutures may be made to alternate. Superficial sutures should include neither muscle nor deep fascia.

In the majority of cases in which sutures·are employed, it is an excellent plan to alternate the sutures with the strapping ; a narrow band of the latter, carefully adjusted between the stitches (as shown in Fig. 210), not only materially aiding the adaptation of the edges of the wound, but, if well applied, tending towards the prevention of tension, and towards the immobility of the wounded part, while at the same time it gives important aid in the way of affording local pressure to the deeper portions of the wound. In operations on the breast, the advantages of this practice are well exemplified.

[If *wire* is employed for the interrupted suture, the ends may be simply twisted, or may be passed through a Galli's tube, or a perforated shot which is then clamped with strong forceps. This variety of the interrupted suture is known as the *shot* or *shotted suture.*]

Continued Suture.—The *uninterrupted, continued,* or *glover's suture* (Fig. 211), is valuable in cases of wound of the intestine, as well as in those of the eyelids and face generally ; indeed, a clean wound of these parts —superficial or deep—may be so accurately and well adjusted by means of a fine needle and thread as to leave but a minimum of

Fig. 211.

Continued suture.

scar. In operations about the lip, the same remarks are applicable, although, in these, care should be observed to introduce the sutures deeply, and well

away from the margins of the wound. In operations for phimosis, in the adult, this form of suture is likewise of great value, not only expediting recovery, but doing much to make the result of the operation more artistic. In these cases the fine carbolized gut suture may be used.

Twisted or Harelip Suture.—The *twisted suture* (Fig. 212) is of value in certain operations on the lips and cheeks, and in other parts where difficulty is experienced in bringing the tissues together, since by its use more force can be brought to bear upon the margins of the wound, and their adaptation can thus be rendered more perfect. This form of suture was in former times the one commonly employed in harelip operations, but it is not so now. I have discarded it in favor of the interrupted suture of silk, silkworm gut, or wire, and employ it only in double harelip operations, or in cases in which exceptional difficulty is experienced in bringing the parts together.

Fig. 212.

Harelip or twisted suture.

[*India-rubber Suture.*—This is a modification of the twisted suture, introduced by M. Rigal and formerly employed by the late W. L. Atlee, of Philadelphia. An India-rubber ring is slipped over the ends of the pin, instead of the twisted ligature, and serves by its elasticity to lessen the risk of causing undue tension.]

Quilled Suture.—This form of suture (Figs. 213, 214) is applicable where deep wounds have to be well held together along their whole line, and more

Fig. 213.   Fig. 214.

Quilled suture.

particularly for a brief period, say two or three days. In ruptured perineum it is certainly of value, combined with superficial sutures (as shown in Fig. 214), but even in these cases the interrupted sutures of silkworm gut, introduced well away from the margins of the wound, and inserted deeply, are probably to be preferred.
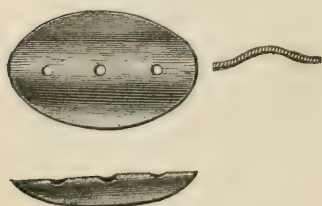
Button Suture.—This (Fig. 215), which is a variety of the quilled suture, is useful in some amputations, as of the thigh, where the surgeon is desirous of keeping the bases of the flaps together. It is useful likewise in harelip or other lip operations.

Fig. 215.

Button suture.

Material for Sutures.—With respect to the material used for sutures—silk, wire, silkworm gut, prepared catgut, or horsehair—each is good in certain cases when rightly selected. Where there is little tension on the sutures, silk or wire may be indifferently employed, the amount of irritation excited by one or the other material depending more upon this point of tension, than on any other. I have long ago proved this to my own satisfaction, by testing both forms in the same subject, through a long series of cases. In *plastic operations*, silkworm gut, well softened in water before use, is to be recommended; it holds well, and seems to irritate far less than any other material. In cases of ruptured perineum, and in operations for vaginal fistula and fissured palate, it should always be used. In the latter class of cases, when the soft palate alone is involved, horsehair is good, but it is not strong enough to resist much tension. In plastic operations in which some skill may be called for in adjusting the parts, wire sutures may be selected, since such sutures can be twisted and untwisted with facility, and the surgeon can consequently readjust the margins of the wound, as required, to his satisfaction. Catgut is not a reliable material for sutures, since it is uncertain as to its retaining power, and is apt, when sodden, to yield; it is, however, useful as a suture in holding parts together for a brief period, where there is no tension, and where there may be a difficulty in removing the stitches subsequently. In operations on the penis, it is of special value.

PRESSURE.—The effectual carrying-out of the third indication in the treatment of incised wounds, viz., the coaptation of the two divided surfaces of the wound—deep parts as well as edges—is not however always to be accomplished by means of sutures and strapping, however well selected and applied these may be. Other means are constantly demanded, and of these, *well directed pressure* is the most important; indeed, the value of pressure in the treatment of all wounds is worthy of more consideration than it has received. By it the surfaces of divided parts are kept together, and particularly the deeper surfaces; mobility of the injured tissues is checked, if not prevented; the vessels of the wounded parts are supported; and the evil influence of blood stasis with its effect—effusion—is neutralized: under these circumstances repair is helped, and nature's processes are permitted to go on under more favorable conditions. With this view of the value of pressure, well-applied pads of lint, absorbent cotton-wool, gauze, or sponge saturated or not with some antiseptic drug, should be carefully adjusted over the flaps of all wounds, when such exist, and over the surfaces of others. These pads are kept in position by means of strapping or bandages, aided by splints when the extremities are involved. After the removal of a breast or tumor, the value of a well-adjusted pad, and more particularly of a sponge wrung out of iodine lotion or carbolized water, cannot be too highly praised. After an amputation, the use of a splint, adjusted to the stump, and pressure well applied to the bases of the flaps, not to their edges, should never be omitted.

IMMOBILITY.—The maintenance of wounded parts in a position of immobility, beneficial to the natural process of repair as well as comfortable to the patient, is the fourth great indication in the treatment of incised wounds ; and to say the least, this is as important as the preceding, since, if neglected, the benefit that might be expected from efficiently meeting the third indication could not be realized, and the process of repair in the wounded part would of necessity be checked, if not altogether prevented.

To carry out this indication, *immobility* of the wounded part is of the first importance, and its *position* next: the position being always selected with the object of giving ease to the patient, and of preventing pain ; of relaxing

the wounded tissues, and so guarding against any tendency to bring about a separation of the edges of the wound, as in cut-throat cases; and last, but not least, of encouraging the return of the venous blood from the wounded parts towards the heart. Thus in wounds of the trunk, the horizontal position is the right one to be maintained, and in those of the extremities, flexion and elevation of the limb; in wounds of the lower extremity, the foot should be kept higher than the knee, and this than the hip; and in those of the upper extremity, the same principles of practice should be followed, the elbow being generally flexed. Under all circumstances, wounded limbs should be fixed upon splints, with the view of immobilizing them, and, as a rule, the limbs should be swung; this practice adds greatly to the comfort of patients, by allowing them to move their trunks without their wounded extremities, and without therefore interfering with repair. It should be added, however, that this question of position ought always to be considered in reference to the *fifth* indication, namely the necessity of providing efficient means for the removal of the superfluous fluids of the part, and for the escape of disintegrated dead tissue which may have to be discharged, or, in brief, for "drainage."

DRAINAGE.—Drainage, or the making of due provision for the escape from the wound of disintegrated dead tissue, with such fluids as are not required for repair, and which if left might prove injurious, is of primary importance in the treatment of all, and more particularly of deep wounds. It should never escape the attention of the surgeon. In scalp wounds, and those about the eyelids, though they may appear trivial, it is of as much importance as it is in the wounds that involve deeper parts and seem more severe; for in the one case as in the other, pent-up fluids not only tend to separate tissues which are intended to unite, giving rise to pain by producing tension, and consequently causing constitutional irritation, but they are prone to excite inflammation in the part, and ultimately to undergo septic changes, which in their turn may give rise to blood-poisoning in the form of septicæmia or pyæmia. No other than trivial wounds consequently should be completely covered in, and deep ones very rarely. Some corner, and preferably that which is most dependent—some interval between the sutures or strips of plaster—should always be left open for the escape of disintegrated tissues, and of superfluous fluids, such as blood or serum; and where deeper structures are involved, some conducting material or "drainage-tube" should be introduced. The best is a tube of India-rubber, perforated at intervals (as originally suggested by Chassaignac, in 1855), of a size varying with the cavity or wound to be drained; but in some cases a strand of carbolized catgut or horse-hair, a roll of gutta-percha skin, or a piece of lint saturated with carbolic or terebene oil, will do as well. In abdominal cases (as after ovariotomy), a perforated glass tube is of great value, while under other circumstances an elastic catheter will answer the purpose. The particular mode of accomplishing the object is of little importance, as long as the object itself is secured. In using a drainage-tube, however, the surgeon must remember that it is not to be made a seton, and that the sole justification for its use is to secure the free evacuation of fluids from the deeper tissues. For this purpose, it is to be made to dip deeply enough into the wound, but no more; it is not to be made an irritant. The size of the tube is to be regulated by the requirements of the case; several short tubes are often better than a long one. Care is also to be taken that the outer ends of the tubes are left free; when covered, they should be covered but lightly, and then with some absorbent cotton, oakum, sponge, or gauze. As a rule, however, they should be left open. In using the tube, when the end is cut off level with the wound, the outer ex-

tremity should be held by means of loops of carbolized silk, perforating its walls and secured externally by strapping or other means. The tubes should always be introduced at what will be the most dependent part of the wound, when the patient is in the recumbent position; and they should be taken away as soon as they have answered their purpose. When quick or primary union has taken place, they may safely be removed at the end of twenty-four or forty-eight hours; but when suppuration is present, they must be left longer, sometimes even till the cavity has closed.

A drainage-tube should, however, be shortened as rapidly as the progress of the case will allow, the shortening of the tube and the closing of the cavity of the wound from below going on together.

It is to be noted that, at the present day, the use of drainage, whether by tubes or other material, is suggested with the view of *preventing* suppuration in the treatment of deep wounds; whereas in former times, when Chassaignac introduced his tubes, it was for the treatment of wounds and cavities in which suppuration already existed. The value of the principle is, however, equally great in both classes of cases. When carbolic acid is used as a wound dressing, whether as a spray or as a lotion—or when chloride of zinc lotion is employed—the use of the drainage-tube is more necessary than it is when other forms of dressing are employed; since under the stimulating influence of these drugs, there is, as Lister tells us, more effusion of plasma than is to be looked for under other circumstances. Whenever a wound is closed, with the view either of obtaining rapid or primary union, or of converting an open, as far as possible, into a subcutaneous wound, the most careful inspection is called for, to guard against and even to anticipate trouble. In these cases, the wound should be opened on the slightest approach of local tension or overaction, with elevation of temperature and traumatic fever, since this local and constitutional disturbance will probably be found to be due to the retention of some of the fluids of the part that are in excess of what is wanted for repair, and to be susceptible of relief only by the evacuation of such retained substances.

PROTECTION OF WOUND.—The protection of the external wound from all such outside influences as may be prejudicial to the progress of natural repair, is the sixth and last indication for the surgeon to follow; and it is in itself as important as the five which have preceded it, since it includes the use of all means by which the wound can be protected from outside injury, as well as the dressing proper, or covering of the wound.

For purposes of protection, most wounds require a covering, and, when they are on the extremities or other exposed parts, some cradle or other mechanical appliance, to keep off the weight of the bedclothes. In wounds of the face, however, coverings are rarely required, for all surgeons are familiar with the fact that there are no wounds, operative or accidental, that do as well as these, without any external application, provided that they have been carefully brought together and adjusted. Indeed, it is probably from a knowledge of these facts that the "open method" of treating wounds has been advocated. This method cannot, however, be recommended, except for wounds of the face. For some years past I have been in the habit of dressing wounds with dry absorbent lint, or with lint soaked in a mixture of terebene, one part, and olive oil, three parts, and have every reason to be well satisfied with the practice. I simply cover the oiled lint with a second piece of dry lint, and fix the whole with some retentive bandage, room being left in all cases for drainage, either by loosely covering one corner of the wound, which is left open for drainage purposes, or by perforating the lint covering the wound, to allow of the protrusion of the end of the drainage-tube. Cotton-wool

of the absorbent kind, is then arranged about the tube, to absorb all fluids that escape, but not in any way to arrest their flow ; since to insert a drainage-tube, and then to smother up its orifice, seems inconsistent practice. When the spray and gauze system (Listerism) is adopted, all the precautions essential for security must be observed, the principle upon which this system is based being one of exclusion not only of air, but of all germs that may be floating in it, which germs are supposed to be the cause of suppuration and of the decomposition of organic fluids. *Wet applications*, and more particularly watery ones, are now seldom used, and cannot be recommended; since it is well known that by moisture, decomposition is encouraged. When they are employed they should be medicated; that is, they should contain some drug which has an influence in preventing or arresting decomposition, or in neutralizing the evil effects of the chemical changes which are sure to take place, either in the contused and devitalized injured tissues, or in the secreted or poured-out fluids, whether blood, serum, or pus. The best of these drugs are the chloride of zinc, carbolic acid, boracic acid, thymol, terebene, iodine, alcohol, the permanganate of potassium, and iodoform.

On the Second Dressing of a Closed Wound.

No fixed period can be named when the first dressing should be removed from, and a second applied to, a wound which is being treated with the view of obtaining healing by quick or primary adhesion. But this is certain ; that no interference should be allowed under a week, unless there is some indication, either in the form of local discomfort or pain, or of some constitutional symptoms, such as an increase of temperature with febrile disturbance, to justify the act. In truth, to use a legal phrase, the surgeon should, in all cases, show cause why he should interfere, before he does so, for it is not to be denied that even with the gentlest and most skilled manipulation, there must of necessity be some interference with the reparative process; some slight tearing away of the new reparative material; some taking away of support where support is essential; or removal of local pressure where such is needed ; in fact, there must always be some injurious influence upon the healing part, which should not be permitted without a compensating good effect. A wound treated for repair by primary adhesion, if let alone, will probably, under favorable circumstances, heal within the week; and a large wound, such as that made in ovariotomy, in excision of the breast, or in amputation, will heal within two weeks under the best conditions. If it does not, it is because there is something wrong with the patient's general condition, or something wrong in the wound, or more particularly its treatment ; for the primary dressing of the wound should have been such as to render early interference with it unnecessary.

To recapitulate, (1) the edges and surfaces of the wound should be carefully adjusted and fixed together; (2) complete immobility of the injured part should be guaranteed by the judicious application of splints, pads, and bandages ; (3) the limb or wounded part should be placed in the most comfortable position for the patient, as well as in that which is most favorable for repair; (4) due provision should be made for the effectual drainage of the wound, and care should be taken that the effect of drainage is not neutralized by any external application or dressing; and lastly, (5) such dressings or external coverings should be employed as will protect the wound from external injury, and guard against or neutralize the decomposition of such fluids as may be poured out. A wound, however large, dressed effectually on these principles, will probably not require dressing for a week, or at least not more than the

removal of the absorbent material which has been placed to catch the drained secretions of the wound; and will be found, when dressed, to be well, or nearly well. A wound, however small, dressed ineffectually, will probably be unhealed and suppurating. The nearer the surgeon can approach perfection in his first dressing, the more successful will he be in his practice, and the larger will be his proportion of cures by primary adhesion.

When a *second* dressing is called for, the surgeon should have at hand everything which may be required for the purpose: lint, prepared in size and shape, and steeped in whatever dressing he may have arranged to use; scissors, forceps, bandages, strapping, absorbent cotton, trays, and irrigators, whether in the shape of a can or in that of a dressing bottle. When the wound is large, and water is to be used in quantity, he should have a piece of water-proofing to place beneath the part, and such assistants as may be required. He is then to remove the external dressings, and in doing this, as in every subsequent proceeding, he is to employ the utmost gentleness. He should, however, beforehand place his patient in the most comfortable position he can, and then place himself comfortably; for no surgeon can do his work well if he is in a constrained posture. In removing external dressings, some time is often required, but it must be granted; for when dressings are glued to a wound by blood or secretion, they must be softened with water, or rather medicated water, before they can be taken away without doing harm. Having taken off the external dressings, sent them away, rolled them up, or thrown them into a basin of antiseptic fluid, and having exposed the part with its sutures, and possibly the strapping which was applied for adjusting purposes, the surgeon is then to cleanse the part, and for this object he cannot do better than to use the absorbent cotton, either dry, or wet with the medicated lotion. The sutures should then be cut and withdrawn, care being observed not to drag a long loop of suture, covered with dry secretion, through the tissues, but to cut it off close to the skin through which it will have to pass. When the union of the wound appears weak, or when it is on an early day after the first dressing that the second is being made, support should be given to the tissues by the application of a piece of well-adjusted strapping, as each suture is taken away; a second and third, or more pieces, being successively applied as the dressing proceeds. If the sutures are not irritating, and the wound has not healed well, they should be let alone. In deep wounds, the surgeon should never be in a hurry to remove sutures, whether they are irritating or not, for if he remove them before good repair has taken place, the wound will gape, and under such circumstances the prospect of securing repair by primary adhesion will have disappeared; and even when the sutures are cutting through from overstretching of the part, it is, as a rule, well to let them alone as long as they have any influence in holding large flaps together, or in preventing wide separation. At the same time, all sutures should be removed as soon as they have answered the purpose for which they were introduced, or when all hope of their fulfilling it has passed away. The removal of a stitch from a wound which is suffering from the irritation caused by tension, and possibly from some collection of fluid, is always wise.

When splints have been used to support and to insure the immobility of wounded parts, they should not be removed unless for some urgent cause. It is to be assumed that they were so applied at first as to allow the surgeon to remove, when necessary, the external dressings without interfering with them. With the same view, of preventing the necessity for its early removal, a splint should be covered with some protective such as gutta-percha, or oiled silk.

To complete the second dressing, a fresh piece of lint soaked in the terebene and oil, or other selected application, is to be laid on the wound, and

the parts covered as after the first dressing, the surgeon taking care to see that efficient means are employed for the external protection, immobility, and good drainage of the wound.

SUBSEQUENT DRESSINGS.—The third and later dressings of a wound must be governed by the same principles which have been laid down for the second ; and they are to be conducted in the same quiet, gentle, and yet decided manner. They are not likely to be very numerous, should primary adhesion be obtained, but when that hope has fled, they must be carried out daily, or possibly more often: they will, however, then have to be conducted on very similar principles, although with different objects.

CONTUSED AND LACERATED WOUNDS.

These wounds, from a clinical point of view, should be classed together, since in both, the edges of the wound are as a rule so injured as to be irregular and the seat of ecchymosis; and since in both, before repair can practically begin, death of some of the injured surface, or of some of the surrounding subcutaneous or other tissue—the margins or flaps of the wound—is to be expected. In the *contused* wound, the breach of surface is brought about by a blunt instrument, moving with a greater or less velocity ; and the extent of bruising or contusion of the soft parts in the neighborhood of the wound, will be found to vary with the size of the instrument which inflicted the injury, and with the force of its impact. When the wounded body is large, the extent of injury will be proportionate; but when the velocity is great, the area of contusion around the edges of the wound will be lessened, as the extent of wound will be increased. The best examples of contused wounds of all kinds are met with in military surgery, as caused by the impact of spent balls or fragments of shell. *Lacerated* wounds are generally brought about by a tearing or biting process, and are characterized by great irregularity of the lacerated tissues from the skin downwards ; this irregularity depends much upon the different degrees of elasticity of the parts torn—skin, arteries, muscles, and tendons, all behaving differently when submitted to a lacerating force.

In *contused* wounds, the area of injury generally extends far beyond the area of the breach of surface, and when death of tissue follows it may spread widely. In *lacerated* wounds, the area of injury is generally more localized ; though this remark is not applicable to wounds in which muscles and tendons are involved. When, for instance, a finger or thumb is torn of, the tendons connected with the injured part may separate at their muscular origins in the forearm.

HEMORRHAGE FROM CONTUSED AND LACERATED WOUNDS.—In both contused and lacerated wounds, there is less primary hemorrhage than there is in those of the incised variety ; the *contusing* force so affects the vessels at the seat of injury, as to favor the coagulation of the blood about their open mouths, or so ruptures the inner and middle coats of the bruised vessels as to mechanically interfere with the flow of blood, and thus encourage the formation of a clot by which the lumen of the injured artery may become occluded ; while the *lacerating* force likewise irregularly divides the different coats of the vessel and its sheath—even in the case of a large artery—and thus favors the coagulation of the blood at the seat of laceration. This temporary plug of the vessel is generally sufficient to close the orifice until nature's permanent hæmostatic processes have had time to act and to seal the vessel.

Secondary Hemorrhage.—In *contused wounds* there is, however, a far greater proneness to *secondary* hemorrhage than is met with in any other form of wound, the contusing force often primarily injuring an artery, but not opening it, yet so destroying the vitality of its coats as to set up an inflammatory, sloughing, or ulcerating process, which in its turn may be followed by the formation of an aneurism, a wound, or a rupture of the vessel, and, as a consequence, by secondary hemorrhage. Contused wounds are consequently of a more dangerous character than lacerated wounds.

Subcutaneous contused wounds, that is, severe contusions of soft parts from the impact of blunt instruments, the passage of a wheel over the part, or other force, without breach of surface or exposure of the injured tissue, are at times more grave than those in which a breach of surface exists. This is best seen by studying the effects of such kinds of injury upon the abdominal and pelvic viscera, an unbroken and apparently uninjured outside surface often covering a fatal subcutaneous rupture of a solid viscus, or a laceration of a hollow one; but the same fact may be also well seen in severe injuries to extremities, where from a contusing force an artery may be stretched, bruised, or lacerated, large veins may be torn across, nerves injured, and muscular and other tissues irreparably damaged.

The amount of harm which deep tissues may have sustained in any given injury, can therefore only be estimated by a correct appreciation of the force which has been applied, and of the position and condition of the injured part at the time of its reception. It can never be made out by simple inspection of outside appearances. Such injuries always demand great care in their treatment.

Treatment of Contused, Lacerated, and Open Wounds Healing by Granulation.

The principles upon which the treatment of contused, lacerated, or open wounds is based, are the same that have been laid down and explained in considering the treatment of incised wounds, though they may require some modifications in their application, on account of the altered circumstances in which they have to be carried out. For example, in a deep *lacerated* wound, the surgeon will have to cleanse it and arrest bleeding, as in an incised wound; but he will not have to adjust the divided surfaces and apply sutures, in the same careful way that he would be called upon to do if "quick union" was to be looked and worked for; and he will remember that this change of practice is demanded in contused and lacerated wounds, because there must of necessity be more or less sloughing or molecular disintegration of the lacerated tissue and contused parts around, and that, as a consequence, it becomes a matter of primary importance to leave the wound open, for the free discharge of all such tissues as may have been destroyed, or may die, as well as for the evacuation of the fluids which must be poured out in the reparative process.

He will, however, in this class of cases as in the former, secure immobility of the wounded part, and fix it in the position which will be easiest to the patient and most conducive to the healing act; and he will not forget to make the fullest provision for the drainage of the wound from its lowest depths. He will, moreover, have to be additionally careful in the dressing of the wound, since it is an open one, as from such, septic matter is more rapidly absorbed before the process of granulation has commenced, and as such a wound is afterwards readily influenced by external applications. In *one* instance, the wound may have to be regarded and treated as an open one from the first,

the excavated surface being filled in with a light dressing, as if it were a surface wound; in *another*, where there is a tendency for the surface edges to fall together and unite, and where this union would be injurious by interfering with the free evacuation of such discharges as are to be looked for from the wound, or with the escape of sloughs of destroyed tissue, the dressing may have to be inserted between the lips of the wound, or even down to its bottom; for it is essential, in these cases, that the wound should not be closed, and that a free vent for all fluids should be maintained; while in a *third* case, the provision for free drainage may, from the position of the wound, be so imperfect, that a special opening (counter-opening) may be called for, at the most dependent situation of the injured parts, or at some other position which the ingenuity of the surgeon may suggest. Under all circumstances, wounds such as these, which are not expected to heal by quick union, should be so dressed as to allow of the free egress of all secretions without disturbing the parts. The primary dressing which I am in the habit of employing for fresh wounds is, as already mentioned, lint or absorbent cotton, saturated with a mixture of terebene one part and olive-oil three parts, the saturated dressing being covered with another layer of dry lint or cotton. Where a wound has to be lightly filled with some dressing, I use the absorbent cotton saturated with the same terebene and oil, and a light pad of the absorbent cotton applied over the whole and held in position by a retentive bandage; and even when a drainage tube or drain orifice exists, the same light dressing is applicable, since it absorbs such fluids as may escape externally, and in no measure tends to restrain their flow. In some cases, a soft sponge which has been wrung out of iodine or carbolic lotion, is a good substitute for the wad of absorbent cotton.

In cases of more severe wounds, where a free flow of fluid is to be expected, and where the danger of its retention would be great, the opening of the drainage tube or discharging orifice should be left free. In the dressing of all stumps, and most deep incised or lacerated wounds, this practice should be followed, since it enables the surgeon to bring the parts more accurately together than would otherwise be advisable, and to keep them quiet, and in apposition, by means of pressure applied over the whole of the wound, except the drain orifice. This method has likewise the great collateral advantage of allowing the surgeon to leave the wound undisturbed for some days, probably for a week, and to postpone his first dressing till a period when nature's reparative process will have had time to shut off the wounded part from the deeper tissues, and to do much in the direction of its repair. There should always be a reason for dressing a wound: dressing as a routine practice is not to be commended; it should always be deferred till it is required.

Wounds must be kept *clean* under all circumstances, and free from every septic risk—contused and lacerated wounds particularly; but a wound must be kept *quiet*, if repair is to go on steadily, and this quiet is as necessary for the lacerated as it is for the cleaner kinds of wound. A form of dressing such as has been described, has advantages over many others, for it renders early and frequent dressings of the wound unnecessary.

Punctured Wounds.

Punctured wounds, when made with sharp-cutting instruments, are deep *incised* wounds, and when with blunt or wedge-shaped tools, deep *contused* wounds. They differ from other incised or contused wounds in their depth, and in the uncertainty which, as a consequence, follows, with respect to the tissues that are wounded; but above all in the difficulties which are always

experienced in providing for the efficient evacuation of blood, serum, or broken-down tissue, where drainage is needed. These difficulties are clearly due to the external orifice of the wound being but small in proportion to the depth of the penetration.

When a punctured wound is made with a clean sharp instrument, into the healthy tissues of a healthy subject, harm need not be anticipated; indeed, quick repair may be looked for with almost as much confidence as if the wound were of the more simple incised kind. This observation is confirmed by the general experience of all who practise subcutaneous surgery, although when large vessels or nerves are wounded, troubles may arise, which are not lessened by being hidden. When, however, a punctured wound is made with a blunt and wedge-shaped, or possibly a dirty instrument, the wound will be of the contused kind, and, being so, will partake of the disadvantages of such wounds in addition to those which appertain to it in itself. It will consequently—on account of its being contused—be associated with death of some of the injured tissues, for the escape of which due provision will be required; and it can only be expected to heal by the second or third intention. On account of its being a punctured wound, it will moreover exhibit the difficulties of providing for proper drainage, under circumstances in which efficient drainage is particularly called for. As a consequence of these conditions, special dangers are developed in punctured wounds, which can only be rightly met by a full recognition of their nature, and of the requirements essential to their prevention.

When tense fasciæ are punctured—such as are found in the palm of the hand, sole of the foot, and scalp—or when deep muscles, bound down by fasciæ, as in the thigh, are involved, and secondary inflammation ensues, the case is often very serious. Punctured wounds of cavities are worse than those of the soft parts covering bones, in the same way that all other wounds of those parts are graver; as well as from the fact that in punctured wounds there is more uncertainty as to the nature of the parts wounded, and that, with this uncertainty, there are, of course, less clear indications for treatment.

TREATMENT OF PUNCTURED WOUNDS.—There is no form of wound which the surgeon has to treat, in which a greater uncertainty exists as to the result of treatment than in the punctured; and all punctured wounds should be dealt with therefore with the greatest caution. When the wound has been inflicted with a clean, sharp instrument, and when it is treated as it should be—as any other clean wound—with moderate compression and the application of a dry or antiseptic dressing, such as terebene and oil—and is then left protected and at rest, to heal—there will be every prospect of repair going on as satisfactorily in a wound of accidental origin, as in those which surgeons daily inflict in their operations of tenotomy and osteotomy. Even when the wound is of the contused kind, and repair by quick union is not to be looked for, the surgeon is probably justified in employing the same means, although in doing so he must be keenly alive to the risks of the case and the dangers of the practice adopted, and must be ready, on the appearance of any swelling, pain, heat, or redness, and more particularly of any elevation of the bodily temperature, or fever, to remove all dressings, expose the wound, and adopt such means as the nature of the case will allow to give vent to the pent-up fluids of the part, and thus relieve the local irritation caused by their retention; to put an end to tension of the tissues; and to do what may be best to check the further absorption of substances which, if not already decomposing and undergoing chemical changes, may soon be so, and give rise to septicæmia and blood-poisoning.

In one case, this may be done by re-opening the external orifice of the

wound; in another, by enlarging it; whilst in a third, a fresh opening may be called for in the most dependent part of the injured region. Under all circumstances, however, the object is the same: to give vent to the pent-up fluids of the part, whether inflammatory or otherwise. At the same time, the injured part should be raised, to encourage the venous circulation through the limb, and, as a rule, pain will be relieved by the local application of warmth and moisture, whether in the form of a compress or in that of a fomentation, mixed with sedatives, such as opium or poppy decoctions. Cold rarely gives comfort in these cases, and it certainly does no good towards checking inflammatory action, since that which is clearly occasioned by retained secretions, is only to be relieved by their removal. For the same reasons, leeches are rarely applicable, although in a plethoric and vigorous patient they may be permissible; but even in such, the judicious use of small and repeated doses of sulphate of magnesium has a more powerful effect for good with less risk of doing harm.

In the treatment of all punctured wounds, the surgeon has only to remember that, as their danger consists in the difficulty of providing efficient drainage, so their treatment turns upon this deficiency being remedied; and the surgeon who, on the first appearance of local or general symptoms indicative of the presence of retained fluids, makes an outlet by one or other of the means which have been suggested—even when the outlet is only for the escape of pent-up serum—will be more successful than another who, from timidity or other cause, leaves the case to run its course, till a large inflammatory abscess has formed from the irritation caused by the fluids which should have been evacuated. In all punctured wounds which do not heal quickly by primary union, and in which secondary inflammation occurs, with its necessary effusion, it is the surgeon's duty to find an outlet for the fluids of the part as soon as the fact of their retention is clear. The artificial formation of a free vent for these fluids will be followed by relief, both locally and generally, and will almost always save tissue; whilst delay in adopting this practice is not only locally deleterious, but may even prove dangerous to life. When thecæ of tendons, fasciæ, and fibrous coverings, as of bones, are involved, the necessity of adopting this practice is more important, if possible, than when the softer tissues are implicated; and an incision into the deep parts for the evacuation of even simple serum, by relieving tension, will often prevent the extension of the inflammation, and prevent destruction of tissue.

Tooth Wounds.

Tooth wounds are usually punctured, and rarely other than contused. They may, as may all other kinds, prove to be poisoned wounds, but to these I do not refer. They differ widely in their character; and whilst one case may appear as a simple, clean, punctured wound, another may exhibit all the worst features of the contused or lacerated variety. They are to be dealt with as punctured or contused wounds, each case being treated on its own merits.

Treatment of an Open or Granulating Wound.

When a wound is granulating, and consequently suppurating, it should be kept clean, as other wounds, and it should be dressed with such a material as may be adapted to protect the granulations from outside injurious influences, and to allow the cicatrizing process to go on without hindrance. The granulations themselves should never, for purposes of cleanliness, be touched

by any coarse material object harder than a camel's-hair pencil, but should be washed by means of a stream of fluid allowed to flow either from the dressing irrigating bottle (see Fig. 208, page 26), or from the irrigating apparatus (Fig. 209), and the washing fluid should be water containing some of the antiseptic salts or minerals to which reference has already been made. In my own practice, iodine water is generally used. It matters little whether the wound be superficial or deep, since a like practice is called for in either case, though where the wound is deep, and where there may be some collection of pus or other fluid, the ingenuity of the surgeon may be taxed to meet the requirements of the case. As a rule, where a drainage-tube is used, the washing out of the cavity can well be effected through it ; and where it is not, the end of the tube which is fixed to the piston of the irrigating bottle answers every purpose. In every case, the wound and cavity must be well cleansed with an antiseptic solution, and this cleansing process must be performed with gentleness and efficiency, in order that, on the one hand, the granulations, whether of the surface of the wound or within the cavity, may not be bruised or otherwise injured, and on the other, that no retained secretion may be left behind to irritate and distend the tissues, or to undergo decomposition.

When the granulating process is not of a healthy type, and when the granulations show either deficiency or excess of power, or some morbid action, medicated lotions and constitutional treatment may be required, to which attention will be directed on another page.

Treatment of Wounds to promote Healing by Secondary Adhesion.

As in the treatment of a fresh wound to obtain "quick or primary adhesion," the surgeon has simply to cleanse the wound, after arresting bleeding, and to bring the two surfaces into close apposition by the simplest means, and keep them so ; thus, in the treatment of a case in which healing by secondary adhesion is sought for, he has simply to bring together the two granulating surfaces, cleansed from all impurities, by such means as are suggested by the special requirements of the case, and to leave them to unite. In harelip or other lip operations, where quick union has been missed, and this secondary adhesion is sought, it may be obtained by the introduction of deep sutures, or even pins; in deep flesh wounds, or after operations, as on the breast, by means of strapping, well applied; and in stumps, after amputations, by means of splints, pads, and bandages. In all cases, the immobility of the part treated is subsequently to be rigidly attended to, and time must be given for union to complete itself before the dressing is disturbed.

Special Modes of Treating Wounds.

To estimate correctly, with the light of our present knowledge, the value of any special method of treating wounds, it is necessary to keep constantly in mind the six points to which attention has been directed, since these points are essential principles of practice which should be followed under all circumstances. Indeed, so essential are they, that the value of any special method of treating wounds may be tested by them, and the method regarded as good, bad, or indifferent, according to the measure or degree in which it fulfils the requirements enumerated. (See page 28.) A mode of dressing which satisfies all these requirements or indications, in a simple and efficient way, must be regarded as perfect; and a mode which embodies in itself the greater number

of these requirements, should be regarded with greater favor than another in which these requirements are less efficiently fulfilled.

With this standard of comparison ever prominent, I will now proceed to consider the more important special modes of treating wounds.

TREATMENT OF WOUNDS BY OCCLUSION. (*The Smothering System.*)—This was without doubt the favorite method of dressing fresh wounds among the older surgeons, and in proof of this it is only necessary to refer to the classical works of John Bell, to read how the processes of *mundifying, digesting, incarning,* and *cicatrizing,* were carried out. This method was doubtless the outcome of much observation, and was based on what was seen daily in the healing of the wounds of animals by one of the natural methods of repair, that of scabbing.

This mode of healing, under a scab, writes Paget, "is the most natural, and, in some cases, the best of all the healing processes. Very commonly, in animals, if a wound be left wide open, the blood and other exudations from it dry on its surface, and, entangling dust and other foreign bodies, form an air-tight and adherent covering under which scarring takes place, and which is cast off when the healing is complete. The exact nature of the process has not been watched, but it seems to consist in little more than the formation of cuticle in the wounded surface, and it has the advantage that, as no granulations are produced, there is little or no contraction of the scar. In man the same process is less frequent ; it is more apt to be spoiled by inflammation producing exudations under the scab, which either detach it or prevent the healing of the surface beneath it. Sometimes, however, the blood shed from a wound coagulates and dries on it, and remaining as a scab, permits healing under it; or, if this do not happen, a similarly effective scab may be formed by the serous fluid or lymph by which the surface of an exposed wound usually becomes glazed ; or, more rarely, the pus of a granulating wound may scab, and sound healing take place beneath it." . . . . .

"*To obtain healing under a scab,* if the wound be recent, the blood and exuded fluids, or, if it be granulating, the pus, should be left exposed to the air till it dries on the wound, adhering to the edges and surface, and completely excluding them from the air." . . . . .

There seems, however, to be a proneness to inflammation " which makes the healing under a scab precarious and less generally attainable than one could wish it. No morbid exudation should take place under a scab once formed ; everything of the kind painfully compresses the wound and retards its healing."[1]

Such is the mechanism of healing under a scab, and such are some of the methods by which it can be brought about. In Sir Astley Cooper's time (1820 to 1840), with the same object, wounds were often sealed with lint or other material saturated with blood, and in more recent days they have been covered with collodion, alone, or applied on linen; with colloid styptic; with tannin in powder; with dry earth; with Peruvian balsam, or friar's-balsam; with cotton-wool, medicated or otherwise. In some country districts, coal-tar is used for the same purpose, and with the same view. Chassaignac's arrangement, by which a wound was hermetically sealed from the air by consecutive layers of plaster covered in with charpie or cotton-wool, has also been employed. The object of each variety of this form of dressing is the same, viz., the complete exclusion of atmospheric air, and in each an attempt is made to place an open wound as much as possible in the position of one which is closed or subcutaneous.

Cotton Dressing.—In recent times, this method has attracted attention under the form of the "cotton dressing," which was introduced in 1853 by Burggraeve, of Ghent, and advocated by Ravoth. In their hands, it was carried

[1] Article on Wounds. Holmes's System of Surgery, Second edition, vol. i. pp. 636, 643. London, 1869.

out by the immediate application of splints, thickly padded with cotton-wool, to the wound and injured limb, and by then not interfering with the injured part for four or six days. If there was at the end of this time neither inflammation nor suppuration, and if there was a firm scab, the wound was let alone, and only the surrounding wool was removed. If suppuration was present, the wound was dressed with cerate. This method has been described by Schultes as the methodical application of so-called healing by scabbing, extended to large wounds.

Dr. Gräf uses cotton-wool and tannin, the latter being spread over the wound in a layer as thick as the back of a knife ; he leaves the dressing untouched for from four to fourteen days. He and Fleck, of Dresden, regard tannin as a simple and cheap antiseptic and disinfectant, and as an unirritating hæmostatic. Both surgeons advocate this method of treating wounds in military surgery.

Alphonse Guérin uses cotton-wool with the view of filtering the air from germs before it reaches the wounded surface, and he applies the wool by smothering the wounded part or limb with many layers, and leaving it undisturbed for twenty-five or thirty days, unless some extraordinary complication should arise—for the occurrence of which a close watch is always kept—to induce him to remove it. Before he applies the dressing, he washes the wound with camphorated alcohol, or carbolic acid, and, in an amputation, introduces the wool between the flaps. When the dressing is removed, there is generally a healthy granulating surface, with a little sweet pus covering it; and the granulations, in the case of a stump, have probably driven out the cotton-wool. This method has the advantage of giving rest to the wounded parts ; the gentle and elastic pressure exerted by the wool is also beneficial ; as is likewise the constant temperature maintained, and the freedom from pain which is the result of these conditions.

Ollier employs the same dressing as Guérin, but he, in addition, sprinkles the wadding with carbolic acid. According to either plan, the dressing is a close one, and is based on occlusion of the part from air, with antiseptic intentions.

Summary.—If we bring this method of treating wounds, by "occlusion," to the test laid down at the commencement of this section, it will be found that it fairly well fulfils three out of the last four essential principles of practice, but fails entirely in the most important—the fifth—that of drainage. That is to say, it includes the careful adaptation of the surfaces of the wound, insures rest and immobility of the part for some days, and provides for the protection of the wound from outside influences, and for antisepsis, but it fails entirely in making the smallest provision for drainage. So that, as Syme cleverly expresses it,[1] "there can be little difficulty in perceiving why the sealing up of wounds should be the most certain means of keeping them open." Under these circumstances, the conclusion is clear, that, whilst this may be a safe and wise practice to adopt in small or superficial wounds, it is a risky and somewhat dangerous method to follow in the treatment of those which are deep or complicated, unless very closely watched. It should never be employed in any case in which the wound is more than superficial, unless the probability of the part healing by immediate union can with good confidence be maintained ; and it should never be employed at all, unless the surgeon, carefully watching the temperature of the patient and the local and general symptoms of the case, is prepared to at once expose the wound if necessary, and to evacuate any pent-up fluid that may be present.

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[1] Lancet, March 31, 1855.

For my own part, whenever I seal a wound with the hope of securing a good result by allowing the parts to heal quietly as in a subcutaneous or closed wound, I never do more than seal it with lint soaked with blood or friar's-balsam, and I take good care to leave the parts otherwise well exposed to observation, in order that I may, if warned by the appearance of any local symptom, such as swelling, heat, or pain, or of any general symptom, such as increase of temperature, or fever, remove the scab, real or artificial, and give free vent to the pent-up fluid. I moreover never apply the practice to any other than a very clean and recent wound.

As a general mode of practice, this method of treatment by occlusion is not to be advocated; in exceptional cases, it may be employed, but then only with extreme caution. In most deep and complicated wounds, it should be rejected. It is only applicable in the very earliest treatment of wounds.

Open Treatment of Wounds. (*Treatment by Exposure.*)—This method was first systematically carried out by a Vienna surgeon, named Vincenz von Kern, in the beginning of this century, and more recently by Bartscher and Vezin, in 1856, and by Burow, in 1866. These German surgeons were led to adopt this mode of treatment by careful observation of the healing process in wounds, and more particularly of the bad results which followed the ordinary methods of dressing by occlusion as then employed in Continental towns, by the use of bandages, charpie, lint, etc. The latter system of dressing wounds, or what has been described as the "smothering method" in which no air could get in, or fluid get out, gave way to the former or "open method," in which the free access of air was the main end sought for, and drainage the second.

The success which attended this practice was moreover considerable, since Bartscher and Vezin had only three deaths out of thirty amputations, and Burow three out of ninety-four.

The method, nevertheless, did not make headway, and it does not seem to have been followed as a rule of practice by any surgeons except Mr. Teale, of Leeds; Professor Humphry, of Cambridge; Dr. R. W. Krönlein, of Zurich; and some members of the Surgical Society of Moscow. The former surgeons in 1858 and 1860, and the latter in 1872, and the Moscow Surgical Society in 1877, have given their respective experiences and conclusions in regard to this method of dressing. [Prof. J. R. Wood's "open method" of treating stumps, may also be considered as a modification of this mode of practice.]

Von Kern's practice consisted in freely exposing the wounded surfaces to the air, and simply keeping the edges of the wound in position by means of sponges. Vezin employed no means for uniting wounds. Burow used sutures, but in such a way that they could be readily loosened in case of distension. Humphry, in 1860, wrote:—

" It is well known that wounds of the face commonly heal up, in their whole length, by first intention. This is due, in great measure, to the vital qualities of the parts, and in some degree also, I apprehend, to the fact that they are usually exposed to the air, their edges being held in contact merely by sutures. For some years we have adopted this plan after amputations and all, or nearly all, other operations. The integuments are united by sutures placed at intervals of about an inch, and the wound, as well as the adjacent surface, is left quite exposed to the air; no plaster, bandage, or dressing of any kind, being placed upon it. . . . . . All the irritation, the galling pressure, the retention of heat, and other inconveniences resulting from bandages and plasters, are thus avoided. The edge of the wound and the surrounding skin being uncovered, the eye can take cognizance of what is going on; and we can cut a stitch here and there, when required, can keep the part clean, or take other measures without difficulty. Forasmuch as no dressings are applied, there are none to be re-

moved. The suffering which used to be caused by the dressing of wounds after operations is got rid of. In many cases I do not touch the wound, except for the purpose of removing the sutures, from the day of the operation. . . . . . We decidedly have more frequent union by first intention than when we were in the habit of applying dressings to the wound. . . . .

"If suppuration takes place, an early and free vent should be afforded to the pus, by cutting the stitches and opening the wound; and care should be taken to keep the wound clean. . . . . Large open wounds—that is, where portions of the skin have been removed, so that the edges cannot be approximated—are in our hospital [Cambridge], not unfrequently, left exposed to the air, without any covering. A dry crust or scab forms upon them, beneath which cicatrization goes on, and we find that the healing often proceeds more quickly in this way than when the part is kept moist and the products of the wound are continually flowing away into the poultices or dressings."[1]

Krönlein tells us, after analyzing six thousand cases, that the open method has proved superior to all others, and demonstrates that the mortality of amputations, which by former methods had been 51 per cent., fell by the open treatment of wounds to 20 per cent.; and Rose, who is the present director of the *Clinique* at Zurich, follows Krönlein. He exposes all his wounds to a free current of air, which is maintained by means of open doors and windows. He regards stitches and bandages of all kinds as interferences to be avoided, and trusts to *absolute rest* of the part, after *careful arrest of bleeding;* to provision for *thorough drainage;* and to *scrupulous cleanliness.* The wounded limb in an amputation is kept in one position, on a cushion so protected by mackintosh that the discharges may easily escape into a vessel placed to receive them.

Some of the practitioners of this system are somewhat inconsistent, since they advocate the frequent ablution of the exposed wound with carbolized water, or its protection by pouring over it the balsam of Peru; and C. Thiersch adds that whether the wound lies quite free, or is covered with a piece of oiled silk, or with a water compress, cold or warm, does not appear to be of importance, if only free escape of the secretions is not prevented thereby; we may also, he says, add irrigation without changing the character of the dressing, as practised by Bardeleben, and the permanent water-bath may also be of use. Thiersch moreover adds that in cases of compound fracture and gunshot injury—since the free escape of secretions is one of the most important points in their treatment—wounds may be enlarged by incisions, abscesses opened, counter-openings made, and even free openings effected into wounded joints, or resections practised.

The conclusions of the Moscow committee are also favorable to the practice, and may be condensed as follows: The essential feature of treatment by *aeration*, as this committee calls it, consists in avoiding all local appliances for excluding air, and in placing wounds in conditions favorable for free and direct contact with the atmosphere. Lint and other such substances should never be used. Repair by primary union should always be sought when possible. Catgut ligatures and metallic sutures should be employed. The advocates of this system believe that the "Lister dressings" are injurious, but that the antiseptics employed counteract the baneful effects of the coverings.

Summary.—The results of this open treatment are evidently satisfactory, and, judged by the essential points to which attention has been directed, the open treatment of wounds may be advocated; for it includes careful adaptation of parts after arrest of all bleeding, and due provision for thorough

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[1] British Medical Journal, Oct. 27, 1860.

drainage ; but, on the other hand, it takes little care to guard against mobility of the wounded part, and disregards antiseptic applications and precautions. This neglect is, however, probably due to the justifiable impression that if drainage be provided for, there will be in the deeper parts no retained dead tissue or fluids to decompose or undergo chemical change, and that a free current of air upon the surface of the wound is the best guarantee against septic changes of its fluids. Indeed, Professor Humphry clearly indicated this when he described how large open wounds, by this system, healed by scabbing more quickly than when the part was covered and kept moist. Some of the advocates of this system believe the open treatment to be more adapted to wounds in which union by *secondary* adhesion is to be expected, since they assert that, if an open wound be maintained in a condition of perfect freedom from all irritating causes, such as foreign bodies, dirt, and decomposing elements, granulations will form, and that suppuration is not an essential part of their formation.

For my own part, after a careful review of the whole question, I must regard the open treatment of wounds as being far superior to any other in which due provision is not made for perfect drainage; but at the same time, I fail to see its advantages over some others, and more particularly over that which I adopt, in which all the advantages of the open system are secured, and in which, in addition, the wounded part is effectually guarded against mobility and external injury, while, at the same time, due provision is made, by means of a light antiseptic dressing, against the possibility of any septic changes taking place on the surface, as well as in the deeper portions of the wound. The recent investigations of Pasteur tend greatly to support the advocacy of this open dressing, since he claims to have proved that germ influence is weakened by contact with the oxygen of the air, and that "it is the oxygen of the air which weakens or extinguishes germ virulence."[1]

TREATMENT OF WOUNDS BY IRRIGATION.—This must be regarded as only a variety in form of the open method, since its essential advantage consists in the cleansing and thorough draining of the wound from all secretions and impurities. It is carried out by means of a can of water or medicated lotion, so placed above the part to be irrigated that the fluid can be conducted by a tube, as a gentle stream, or, what is better, by means of worsted threads, in rapidly falling drops, upon the exposed and wounded part, the limb being fixed upon a splint, with a pan beneath to catch the fluid as it drains away.

In gunshot wounds of limbs, and in sloughing or unhealthy stumps, or wounds, this mode of treatment is very satisfactory. It has been employed in Guy's Hospital for a quarter of a century, and can be recommended. Esmarch speaks highly of it in military surgery.

TREATMENT BY WATER-DRESSING, WITH AND WITHOUT ANTISEPTICS IN SOLUTION.—In 1825, the late Mr. Syme published a paper[2] in which he pointed out the evils of such old methods of dressing wounds as those of mundifying, digesting, incarning, and cicatrizing, and recommended that wounds should be lightly dressed, after their edges had been adjusted and well brought together with stitches. To this surgeon, in connection with Mr. Liston, may be probably attributed the introduction into British surgery of the use of water-dressing for wounds generally. The practice was very rapidly taken hold of and adopted, every thoughtful surgeon having recognized the evils that attended the methods in which wounds were smothered with masses

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[1] Remarks before the Académie de Médecine, Lancet, Nov. 6, 1880.
[2] Edinburgh Medical and Surgical Journal, vol. xxiv. p. 52, July, 1825.

of charpie, lint, or other material, and left to heal as best they could, under cover of these masses of dressings saturated with blood, serum, or pus. The practice, moreover, was simple and cleanly, and, when perfected, was comfortable to the patient to whom it was applied; that is, it became so, as soon as the value of a piece of oiled silk, or thin gutta-percha tissue, applied over the wet lint, was recognized, the wet lint before this improvement having soon become dry, and what might have been at first a wet dressing, having been thus converted into a dry one. The water-dressing likewise soon took the place of poultices, for by one, as by the other, warmth and moisture were applied to the wound.

In 1835, M. Josse, a hospital surgeon of Amiens, published a book on the use of cold water in surgical dressings, and advocated its use, *first*, as a trustworthy and efficient means for the control of inflammation in parts not wounded; and *secondly*, as a dressing for wounds.[1]

If we had the choice, he says, referring to the treatment of the first class of cases, in which there is no wound, "it might be established as a general principle that we ought to employ water by affusion with a continual stream, but the nature of the parts, or of the disease, may prevent this, and oblige us to recur to another method; thus, linen moistened with water, and renewed without ceasing, may to a certain degree prove a substitute for the affusions, but this mode requires much attention."

He subsequently describes his own method: "A vessel with a cock near its base is filled with water, and placed upon a narrow and high table, near the patient's bed, in such a position that it shall be about a foot and a half above the diseased limb, beneath which a cerecloth is spread, intended to guard the bed, and facilitate the flow of the water, which is received in a bucket, placed near for that purpose, and into which the extremity of the cerecloth descends." "The diseased part should then be placed in the most convenient position; it should be lightly covered with compresses; an additional piece of linen should surround the cock by one of its extremities, while the other is extended over the highest point of the apparatus. This is destined to prevent the water from falling with all its weight on the diseased part, and rather to disperse it over a larger surface."

I have described this method of using cold water fully, for it is one now recognized as the treatment by "irrigation;" which, whether employed as cold affusion to check inflammation in injured parts, as in joints, or to keep wounds clean, is of great value.

M. Josse likewise advocated the use of cold water as applied to gunshot or lacerated wounds generally, and in this received the support of the best military and civil surgeons. He declared that—

"When cold water is applied directly after the injury, before reaction has taken place, and when it can be maintained with energy proportionate to the occasion, the phenomena of reaction will be prevented; heat, pain, and swelling will be subdued; and consequently sympathetic fever will not take place; but when the cold has not been applied before the development of the inflammatory symptoms, they will still be conquered by its efficient use."

In these opinions most surgeons will agree, for at the present day the value of cold in checking and controlling inflammatory action is fully recognized; but cold is not now often employed in the manner described, the introduction into general use of ice and ice-bags having led to the adoption of simpler and more effective methods of application. The metallic coil of Leiter, of Vienna,

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[1] ["A great deal has been said," says Liston, "about water-dressing, and the merit of introducing it. Water has been applied to sores from time immemorial. The simple element, water, was supposed to be congenial to wounds and sores; it was used to cool parts. The water-dressing has been used in my hospital and private practice for a long series of years, etc." (Practical Surgery, p. 162. Philadelphia, 1838.)]

is probably the best method of applying cold. I have used it freely and like it much. It seems to embody in itself all the advantages, without the disadvantages, of all other known methods of refrigerating a part.

However valuable cold-water compresses or bandages, hot fomentations, or a warm-water dressing, may be for application to parts that have been injured, bruised, or inflamed, they cannot be strongly recommended as dressings to parts in which wounds exist, for it is now a fairly well-recognized fact that water, *per se*, helps better than anything else to encourage in an injured or half-dying tissue, as well as in the secretions of a wounded part, chemical and fermentative changes, by means of which septic poisons are generated, or made to flourish, and from the absorption of which blood-poisoning is known to follow. Water, holding some antiseptic substance or salt in solution, may, however, be used, the antiseptic preventing or neutralizing the septic changes which the water by itself might encourage. In wounds, therefore, that are much complicated with contusion and laceration of parts, and to which hot or cold fomentations seem applicable, these medicated water dressings may be employed; it being left to the fancy of the surgeon, whether he shall use carbolic acid, 1 in 20 of water; boracic acid, 1 in 50; salicylic acid, 1 in 50; thymol, 1 in 1000; iodine tincture, 1 in 80; or permanganate of potassium, 1 in 50. For my own part, I have for years given up using water as a dressing for wounds, whether with or without antiseptic substances, for I have found that oily solutions of the same substances have advantages over the watery preparations which render them far safer and more satisfactory. Oily antiseptic applications are without doubt the best dressings for wounds which we possess, and of these, one composed of terebene one part and olive oil three parts, deserves, as already mentioned, the preference.

DRY DRESSING OF WOUNDS.—A dry dressing to a wound is to be preferred to one of which simple water forms a part, since with it the sanguineous or serous exudations are more or less absorbed and rendered inert, and the surface of the wound is kept quiet and protected, as by a scab, from outside injurious influences; whereas, with a water dressing, the injured surface of the wound and the wound-exudations are encouraged to undergo chemical and fermentative changes, by which the risks of absorption of septic matter or poison are much increased, and the dangers of the simplest wound greatly enhanced. If the dry dressing be composed of some absorbent material, such as the absorbent cotton or lint, and impregnated with an antiseptic substance, such as boracic or salicylic acid, or iodoform, its efficacy will be increased, since the dressing, under these circumstances, may be left untouched for some days, even for a week, and the healing of the part will not, therefore, be interfered with. Repair, as a consequence, will go on with greater rapidity and certainty; the secondary wound dangers will be diminished, and the ultimate issue of the case will be rendered more satisfactory.

When a wound is *small*, and the surgeon has no doubt as to the propriety of seeking to obtain its immediate union, the dry dressing can be recommended, for it, without doubt, helps better than any other to bring about the "quick union" which is sought. When the wound is *large*, or *deep*, the same recommendation cannot be made, and the dry dressings, if used, should only be so after every care has been taken to provide for the free drainage of the part. They should, moreover, only be employed when there is a reasonable hope of the parts healing by primary union. When a wound is *much lacerated* or *contused*, dry dressings are not applicable, since in these no surgeon would entertain the thought of repair being brought about by rapid union, and where this hope cannot reasonably be entertained, the use of the

dry dressings should be discarded. In brief, in all wounds, small or large, when repair by "quick union" may reasonably be looked for, dry dressings are applicable, due provision having been made for efficient drainage. In all lacerated, contused, or deep wounds, in which repair by granulation is to be expected, these dressings are not to be recommended.

EARTH DRESSINGS.—Earth, as a dressing for wounds, has doubtless been used by savage nations from an early period of the world's history, but it was first brought before the notice of surgeons by Dr. Addinell Hewson, of Philadelphia, in 1872; and from his work upon the subject, it seems that he first resorted to this mode of treatment in 1869. Dr. Hewson was first led to employ the earth as a deodorizer, in a bad example of compound fracture of the leg; and, as the results in this case were good in all respects, he began to employ it as a primary dressing to wounds. The earth used by Dr. Hewson was dried, yellow, ferruginous clay, which had been well sifted through a fine flour sieve, and he claims for its use many advantages. He maintains that it is cool and pleasant to the patient as a local application, and that it has a marked influence in soothing pain. In burn cases and in those of carbuncle, this relief is very striking. Dr. Hewson has satisfied himself that earth, besides being a deodorizer, has a marked influence in preventing putrefaction; that in no case does it provoke or aggravate inflammatory action in a wound, but that in many, it retards or arrests it; and, above all, that it promotes the healing process in wounds of every description, as well as in ulcers. The way in which the clay acts as a dressing may not be clear, but it seems reasonable, from the evidence adduced by Dr. Hewson and others, to conclude that it has by its powers of absorbing gases, and more particularly oxygen and ammonia, a chemical action upon the part to which it is applied, and that by virtue of this action it is an efficient means of delaying decay and putrefaction, and of preventing fermentation in animal tissue. Besides this, it excludes air from the wounded tissues, absorbs moisture and excess of discharges, and helps in a measure to give support to wounded parts.

The dressing is applied directly to the wounded or ulcerated surface, by dusting over it the pulverized clay; or, in the case of a stump, by placing it upon a bed of dry clay, in a box extemporized of binder's board, and by completely covering in the whole surface with some more clay. In some cases, when the clay becomes saturated with the discharges, the dressing has to be renewed daily; in others, it may be left for two or more days.

Upon the whole, this mode of practice has not extended far beyond the sphere occupied by its originator, and it does not seem to possess any advantages over the more cleanly and simple processes which are now at the disposal of surgeons. Some years ago, when Dr. Hewson was in London, I was tempted to give the method a trial; but I soon gave it up, as experience was not in its favor. The dirtiness of the dressing was not compensated for by any advantage. This, however, may have been because I was unable to obtain the right kind of ferruginous clay.

ALCOHOLIC DRESSING OF WOUNDS.—Hippocrates, Paracelsus, and others employed wine as a dressing to wounds, and they did so under the idea that it dried the part, and in the belief that a dry condition was nearer a state of health, whilst humidity was nearer that of disease. Their followers used wine in which astringents were dissolved, such as gall-nuts, oak-bark, etc. All did so, moreover, with the view of arresting bleeding. In more recent times, the alcohol dressing has been made popular by Nélaton, who used it largely, and found it of value. It may be applied in the form of simple alcohol, or, which seems preferable, in that of the camphorated spirit of

wine, as originally used by Dionis. The dressing is said to be a coagulant and astringent, and, with such properties, to favor primary adhesion. In open wounds, it is said to act as a healthy stimulant to the granulations, and as a disinfectant, thus helping repair, and guarding against septicæmic changes and other wound complications.

Nélaton employed compresses saturated with alcohol, and he believed the camphorated spirit to be useful only in proportion to the alcohol it contained. M. Chédeverque asserts "that camphorated spirit of wine is without contradiction the best disinfectant that can be found for the treatment of wounds and ulcers," and he makes this statement after a careful investigation into the value of every known antiseptic, not excluding carbolic acid. The spirit is supposed to have the power of dissolving the pus cell, and of obviating its tendency to decompose, and of closing any open vessels. Maisonneuve bathes the raw surface of the wound with the spirit, and, having brought the divided edges together, and having adjusted them with sutures or adhesive plaster, so placed as to allow of the free escape of discharges, envelops the whole in a bandage steeped in tincture of arnica, and at times applies over the whole the apparatus for "pneumatic aspiration," which will be again referred to. The disinfecting and cleansing power of the spirit, applied in this manner, probably helps the draining influence of the aspirator.

Upon the whole, the alcohol dressing may be favorably regarded, whether simple alcohol or spirit of camphor be employed. It has, without doubt, a cleansing, and probably a disinfecting influence on a wounded surface, while, at the same time, it helps materially to arrest capillary bleeding and that serous oozing which is so detrimental to primary union. In its use, however, the surgeon should never be induced to forget the value of the other essential points of practice to which attention has been drawn, and particularly drainage.

PNEUMATIC ASPIRATION AND OCCLUSION.—Maisonneuve's method of "Pneumatic Aspiration," which he employed with some success before 1867, and J. Guérin's plan of effecting "Pneumatic Occlusion," promulgated in 1865, have already been described in the article on Amputations, Vol. I. page 595. It is essential that the aperture of the India-rubber cap, in Maisonneuve's apparatus, should fit the limb accurately, but the crown or lower part may hang some distance from the wound. A few strokes of the piston, morning and evening, suffice to draw the discharges from the stump into the jar, where, in the absence of air, they accumulate without danger of decomposition; while the healing of the wound is facilitated by the accurate and immovable adaptation of its surfaces, and by the exclusion of air. This practice of Maisonneuve's has three main objects in view, all of which are of importance: (1) to check the formation of matter; (2) to prevent its decomposition when formed; and (3) to prevent its poisonous action on the system by entrance into the circulation. It is essentially based upon the principle of drainage, and in that point of view is valuable. In exceptional cases, and particularly in certain cases of amputation, it may be employed, but as a general mode of treating stumps it does not appear to possess such advantages over simpler methods as to make up for the difficulties and expense of its employment.

ANTISEPTIC IRRIGATION OF WOUNDS.[1]—The value of the antiseptic irrigation of wounds is not, at the present day, likely to be disputed by any surgeon, and a difference of opinion is only probable as to the antiseptic which shall

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[1] [The treatment of wounds by Prof. Lister's "Antiseptic Method" is described in a separate article, page 63.]

be used, the mode of its application, and the character of the wound to which it is applicable. Every surgeon seeks to make and to keep his patients' wounds as clean as possible, and by means of antiseptic solutions or applications to destroy, neutralize, or guard against any and every outside or local influence that can possibly bring about or encourage chemical or fermentative changes in a wound.

It is true that, within the last few years, a school of surgeons has been formed, the members of which talk of "Antiseptic Surgery," and claim for themselves the title of "Antiseptic Surgeons," as if it were applicable to themselves alone, or rather to such of their body as have a belief in the germ theory as a cause of most, if not all, the surgical ills to which wounded flesh is heir; who assert, rather loudly and dogmatically, that "antiseptic surgery" must stand or fall with the theory upon which their practice is based; that no unbeliever in the theory is likely to carry out the practice with any probability of success, since it is only by a staunch believer in the theory that care and attention to every detail of treatment, sufficient to bring about a good result, are likely to be given.

It is true, also, that the results claimed for this practice are great, very great, beyond all previous belief; that, according to these gentlemen, operations which in former times were looked upon as dangerous, can now be undertaken with "certainty" of success; and that others which have hitherto been regarded as unjustifiable, are now legitimate and safe. In fact, the upholders of this theory and adopters of this practice maintain that exploratory and operative measures, which have been regarded as being beyond the province of the surgeon, may now be calmly and quietly undertaken with a "moral certainty" of being followed by a good result. Thus it is that our sanguine *confrères* talk of cutting into healthy joints with the "certainty" that no danger will follow, and declare that great operations upon the bones of the knee may be undertaken with the feeling that in so doing we do not subject the patient "to any risk whatever." That a wedge-shaped piece of bone may be taken from a deformed femur, with the confidence that such a produced compound fracture is "perfectly safe," and "without risk;" and last, but not least, that the peritoneal cavity, under "antiseptic precautions," may be opened "with impunity."

I need hardly say that much of this is bold assertion and nothing more, and that it is apparently due to the sanguine temperament which seems attached to those who pin their faith to a taking theory, and adopt the practice which is based upon it, in blind deference to the authority of its distinguished originator; for facts, calmly looked at, neither by their number nor by their weight, justify these conclusions, but irresistibly suggest that an enormous superstructure has been raised by the ingenuity of its builders upon a narrow foundation, and that good results have been too hastily attributed to causes which have been but some of the factors of a work to which others equally potent for good have without doubt contributed. Facts, indeed, have been employed by our self-styled "antiseptic" friends, as legal advocates use small data which tell in their favor, to support the cause they have in hand; but not as the judge who has to weigh evidence, and with an unbiased mind give judgment. It is only by this explanation that we can understand how the "antiseptic surgeon," when he gets a good result, is so fond of asserting that such could not have been brought about by any other form of practice than that which he has adopted; and, when he is attempting an operation which may in all truth be called experimental, if not rash, maintains that he undertakes it "under the spray" with all confidence, and with a moral certainty of meeting with success.

We must admit, however, that surgery is now much more successful than

it was twenty years ago, and that of the many factors which have brought about this result, the employment of antiseptics stands foremost; and if we are not altogether indebted to Mr. Lister for their use, we are unquestionably indebted to him for the able and persistent manner in which he has both advocated their employment and demonstrated their value. All honor, therefore, to the name of LISTER, for having helped, more than any one else, to establish the value of antiseptic drugs and antiseptic precautions in the practice of surgery, all over the world. Let those who smile at his theory, join with those who believe in it, in giving him this just meed of praise; and let those who do not believe in the efficacy of the spray, do their best to prove to those who do, that all the advantages of the "antiseptic system" can be obtained by simpler means than by its use.

Amongst these means, what must be called the *antiseptic irrigation of wounds*, in my judgment, stands foremost. *Antiseptic irrigation* means the washing of a wound with an antiseptic solution, with the view of destroying any and every germ or element that might possibly set up chemical or fermentative changes in its secretions. It is as applicable to fresh wounds, accidental or operative, as it is to the suppurative or foul, and it is as valuable as a preventive as it is as a curative means. In my own practice, the solution employed is, as has already been mentioned, iodine water—that is, a mixture of the tincture of iodine and water in the proportion of one part to thirty— and, after operations, this should be applied hot. It may be used by means of the irrigating bottle, described at page 26 (Fig. 208), or by means of sponging. When sponges are employed, they should be well soaked in this fluid, and subsequently, before the wound is dressed, should be used to absorb all excess; for this lotion, when applied warm, has more power than any other of which I know, to bring about that desirable "glazing" of a wounded surface which is so valuable as a first step towards quick or rapid repair, and to check capillary bleeding. In suppurating wounds, the same lotion cleanses better than anything else, and has the power of destroying germs of evil, as well as other more vaunted germicides. For the irrigation of a chronic abscess, or sinus, it is equally to be advocated; indeed, as a purifying and antiseptic lotion for all wounds of external parts, as well as for all suppurating cavities, it can be highly recommended. I have employed it for years past, as a purifying agent, but without germicidal intention, with excellent results; and although I have seen much of the spray and carbolic acid practice, I cannot yet see that its results are better than my own. Those who prefer carbolic acid as an antiseptic, can use it in the same way, in the strength of one in thirty or forty; and thymol, boracic acid, chloride of zinc, oil of eucalyptus, or any other known antiseptic, may be similarly employed. The essential parts of the practice consist in the thorough ablution of the wounded or diseased part with the antiseptic solution, after the arrest of all bleeding; the drying of the surface of the wound as far as possible with an antiseptic hot sponge, applied with moderate pressure; and subsequently the careful dressing of the wound with some antiseptic substance, in the way that was described on page 33.

SUBCUTANEOUS WOUNDS.

When John Hunter, in 1794, in describing injuries, divided them into those in which the injured parts did not communicate externally—as strains, bruises, simple fractures of bones, or divisions of tendons; and those which had an external communication—as compound fractures and wounds of all kinds; and laid it down, moreover, as a law, that the injuries of the first class seldom inflamed, whilst those of the second commonly both inflamed and suppurated;

he established a principle of which "indeed it seems hardly possible to exagge-rate the importance" (Paget), and laid the foundation of a branch of surgical practice now known as *Subcutaneous Surgery*. Why it is that extensive in-juries to soft parts, when covered with skin, should undergo quiet and thor-ough repair, with little or no constitutional disturbance, may not be clear; but daily experience teaches us that dislocations of large joints, fractures of bones, severe contusions and lacerations of soft parts, associated with copious local hemorrhages, and even crushes of all the subcutaneous tissues of a foot or hand, as a rule, do well, provided that they are not interfered with by meddlesome practice, but are placed in the most favorable position for natural repair to carry out its silent work. Whereas the same experience tells us, with no uncertain voice, that the presence of a wound, however small, may change matters all round, and turn an injury which, had it been subcutaneous, might have been regarded as trivial, into one of a serious and complicated kind; and this fact is well exemplified in the different course usually taken by a simple and a compound dislocation or fracture. What there is in the air that makes this wide difference, is now, as it ever has been, open to argument; and whether it is the stimulating or chemical influence of the oxygen, the irritating influence of atmospheric germs, the length of time the part is ex-posed, rather than the mere fact of exposure, or some other cause, may be subject to dispute. In modern times, the germ theory has found much favor, and has been the fashion; and attempts have been made to assign to the presence of germs every evil influence, and to regard these as the cause of inflamma-tion and suppuration in every open wound. But this view can hardly be sustained, for, on the one hand, even in subcutaneous injuries, in which no air can get in, inflammation and suppuration may ensue; while, on the other hand, in even severe examples of fractured ribs, complicated with emphysema over the chest, body, head, and extremities—in cases in which the whole cel-lular tissue of the body seems infiltrated with unfiltered air under most unfa-vorable circumstances—it is quite exceptional for any inflammation of the infiltrated parts to take place; indeed, I may say that I have never seen an instance in which it occurred. As corroborative evidence, I may refer to some observations made in 1857, by Malgaigne, who, to test this question, made animals emphysematous with common unfiltered air, and then fractured their bones, divided their tendons, and opened their joints, *subcutaneously;* though the parts operated upon were surrounded with air, no inflammation followed.

For my own part, I am disposed to think that it is not the mere exposure of a wounded part to the influence of air, that does the harm, but its pro-longed exposure; since it is certain that where wounds are sealed rapidly, after the receipt of an injury, and are thus placed much in the position of subcutaneous injuries, repair goes on silently and well. Even bad compound fractures, when sealed early from the influence of air, heal, as a rule, like sub-cutaneous injuries.

REPAIR OF SUBCUTANEOUS WOUNDS.—It may be accepted as a truth, that subcutaneous wounds are repaired much in the same way as open wounds that heal by quick or primary union; that is, when the wounded parts are brought or kept in contact, they simply reunite; and this applies to hard as to soft tissues. The process of repair in both cases is a quick physiological one, not unlike that of development and growth. The action that attends the process is just enough to bring about the required result, but no more; when it is excessive, inflamma-tion is said to exist, and this inflammation, in subcutaneous as in open wounds, always prevents, checks, arrests, or undoes the work of repair. In truth, the less there is of inflammation in a wounded part, subcutaneous or open, the more

perfect and steady is the reparative process.   Surgeons are well aware that when inflammation occurs in a part which has been the seat of some subcutaneous operation, the process of repair is likely to be interfered with, if not arrested; for, as Paget observes, the more manifest are the signs of inflammation, the less is the quantity of the proper reparative material, and the slower in the end is the process of repair.

When tendons are subcutaneously divided and drawn asunder, their repair takes place as follows:[1]—

When such a tendon as the tendo Achillis is divided subcutaneously, the divided ends separate, in an infant for half an inch, and in an adult for from one to two inches, the degree depending much upon the healthy condition of the divided muscle, and the amount of movement subsequently permitted in the ankle-joint.   The reparative process begins with increased vascularity in the sheath of the tendon, which is followed by the infiltration of a blastematous material into the meshes or spaces between its fibrous elements, exhibiting the development of innumerable small nuclei, a few cells of large size and irregular form, with granular contents, or, perhaps, with one or more nuclei, and studded with minute molecules of oil ; a blastematous material, in which the cell forms do not develop beyond the stage of nuclei, appears to be the proper reparative material from which new tendon is developed.   This nucleated blastema soon becomes vascular, capillary vessels having been seen in it on the eighteenth day; the nuclei assume an elongated, spindle, or oat-shaped form, and are seen after the addition of acetic acid to be arranged in parallel linear series.   The tissue becomes gradually more fibrillated, and at last fibrous—a solid bond of union subsequently forming between the divided extremities of the tendon, which is tough to the touch, but to the eye presents, for at least three years, a grayish, translucent appearance, distinguishing it at once from the glistening old tendon.   This new tissue remains during life as permanent, and has little tendency to contract subsequently.   Adams's observations rather lead him to the conclusion, that the required portion of new tendon may be obtained during a lengthened period of formation, that is, about two or three weeks, under the ordinary conditions of health ; but that in paralytic cases, or with patients of feeble health, this period may be doubled.

Adams informs us, also, that the divided extremities of the old tendon take no active part in the reparative process during its earlier stages, although the cut ends subsequently become rounded, and their structure softened.   They become enlarged and exhibit a tendency to split, and thin streaks of new material, similar to that already described, are seen between the fibres ; the ends are joined by these means.   At a later period, the bulbous enlargement gradually diminishes.   When a tendon is divided a second time, there is but little separation of its ends, and this is probably due to adhesion of the new tendon to the neighboring fibro-cellular tissue, in which fact is found an explanation of the unsatisfactory results of second operations.   There is no reason for believing that, in the treatment of deformities by tenotomy, direct approximation and re-union of the divided extremities of the tendon must first be obtained, and that the required elongation is afterwards procured by gradual mechanical extension of the new connecting medium, as we would stretch a piece of India-rubber.   When much blood is effused between the divided ends of the tendon, it has to be absorbed; it acts merely as a foreign body in the part, and retards repair.

TREATMENT OF SUBCUTANEOUS WOUNDS.—When rightly treated, these wounds are generally repaired readily, and, as Hunter asserted, without inflammation; but when not rightly treated, "the subcutaneous nature of a wound is not of itself a sufficient protection against inflammatory complications," "and a clumsily performed subcutaneous operation may be as dangerous as an open wound; sometimes even more so" (Adams).   In the treatment of these, as of

[1] British surgeons are chiefly indebted, for their knowledge of the process of repair in subcutaneous wounds, to the investigations of Sir James Paget and Mr. W. Adams, and the description in the text is mainly taken from the latter author's work on the Reparative Process in Human Tendons, etc. (London, 1860.)

open wounds, there are, consequently, essential points of practice to be observed, in order that good results may be obtained; and these are not unlike those which have been laid down for the treatment of open wounds. That is to say, the injured parts are to be placed as far as possible in a position of ease, and in one in which the contact of the divided tissues is assured, when contact is called for. The parts are, moreover, to be fixed by splints, bandages, or other dressings, in a condition of absolute immobility. The seat of injury is to be protected from all outside injurious influences, and to be supported by moderate pressure; and, what is more, is to be undisturbed, in order that neither by manipulation nor movement shall repair be retarded; for a subcutaneous wound is as susceptible to injury from mechanical interference as is an open wound.

In treating the wounds made by the operations of subcutaneous surgery, the same principles of practice are applicable, and they are well summed up by Adams as follows:—

"There are certain conditions which must coexist to render the subcutaneous operations exempt from inflammation. These conditions are : 1st. That the knife used must be of small size. 2d. That the operation must be performed quickly and neatly, with decision rather than force, and with as little disturbance to the soft parts as possible. 3d. That the wound must be immediately closed, and a compress and bandage applied, so as to prevent effusion, and to support the part. 4th. That perfect quiescence to the part be insured for three or four days, and the dressing remain undisturbed. When all these conditions are strictly observed, it matters little whether large muscles, or tendons, or ligaments are divided; or even whether the large joints of the body are opened."

From all this, it is to be gathered that in the treatment of subcutaneous wounds, whether of accidental or operative origin, there are four essential requisites to be provided for, viz., Position, Immobility, Pressure to support the parts, and Time for repair to perfect itself.

COMPLICATIONS OF WOUNDS.

On the well-founded assumption that a wound, when made into healthy tissues in a healthy subject, will heal by natural processes if placed in the most favorable position for repair, and not interfered with, it cannot well be disputed, when a wound does not heal thus kindly, that there must be some obstacle or hindrance to its natural progress; and this will doubtless be found either in the nature of the wound itself, or the mode in which it has been treated, or in the peculiarities of the subject of the wound, or the surroundings of the case.

When the hindrance is due to *the wound itself*, or to its *treatment*, it may be that some foreign body has been left to irritate; that the hemorrhage which ensued primarily on its receipt has not been effectually arrested, and that a clot has formed between the edges of the wound; that a "recurring" bleeding has taken place within a day or so after the infliction of the wound and its first dressing, from some imperfection in the treatment of the bleeding vessels, or from excessive reaction; or that a collection of serum has been allowed to form in the depths of the injured tissues. In most of these cases, the causes of non-repair are clearly referable to a want of care or skill on the part of the surgeon who has had the early treatment of the case, and must be set down as preventable causes. By the same want of care, the edges of the wound may not have been properly adjusted or kept in apposition; the injured limb may not have been made immobile; and, as a result, spasmodic muscular movements and jumpings of the limb may have been excited;

no provision, or an insufficient provision may have been provided for drainage, and, as a consequence, the wound may have been irritated by retained secretions, and possibly made to inflame by the tension which the retained secretions have produced. Harm may also have been brought about by the want of due attention to the dressing of the wound, and to its efficient protection from outside injurious influences. Other causes of non-repair may be the unsuitable character of the applications with which the wound is dressed, of the position in which it has been placed, etc.

When the obstacle to natural repair exists in *the subject of the wound, or in the surroundings of the case*, it may be that it will be found in the age, temperament, or feebleness of the patient—as expressed by deficiency in the healing act, excess of pain, or inflammation of the wounded parts; in the unhealthy atmospheric condition of the chamber or residence in which the patient rests, as shown by unhealthy action in the wound, erysipelas, or septicæmia; in the unsuitable character of the patient's food; in want of proper nursing, etc. Under any circumstances, the obstacle to repair will be found in one or more of these causes, and it is for the watchful eye of the surgeon to discover the particular defect, in order that he may apply the proper remedy. It is well, however, for the student to recognize the fact that most of these causes are preventable, and that they are as a rule due to some want of care in the primary dressing of the wound; let it be repeated, therefore, that in all cases, and under all circumstances, too much care cannot be bestowed upon the management of fresh or recent wounds, to carry out the essential points of treatment to which attention has been so often drawn.

Consecutive Hemorrhage or Recurrent Bleeding.—This form of bleeding is that which takes place within twenty-four or forty-eight hours after the reception of the wound. When it occurs, it is of little consequence whether it is to be attributed to some imperfection of the means employed to check the primary hemorrhage, or to the re-opening, during the period of reaction, of a vessel which had been temporarily sealed by a clot at an earlier period of the case. It has to be dealt with, and with decision. When trifling in amount, it need not be regarded with anxiety, and more particularly when there is room for the blood to escape through the drainage opening or tube, although even then it will be well for the surgeon to see that the wounded part is elevated and watched. If the bleeding vessel be a small or cutaneous one, these means will probably be enough. If, however, the bleeding is persistent, or if the parts about the wound swell, and become tense and painful, and more particularly if pallor of the skin, feebleness of pulse, restlessness, and other signs of collapse furnish definite signs and symptoms of loss of blood, the wound must be re-opened, the clots turned out, the source of the bleeding looked for, and the vessel secured. At times the mere opening and exposure of the wound will arrest bleeding, and, under these circumstances, when the bleeding vessel cannot be found, it is well to leave the parts exposed for a few hours, and either to bring them together again when they have glazed, and when most chances of bleeding have passed, or to leave them open to granulate. The wound should, however, be left open under only exceptional circumstances: when the hope of quick union is very small, or when such union is undesirable.

When the bleeding vessel has been found, it is to be secured, and the wound treated as a fresh one, and reclosed. At times, where oozing of blood is persistent, moderate pressure upon a wound does much good; and this may be well applied by means of an ordinary, or a rubber bandage over a sponge or elastic antiseptic pad. Care must be taken, however, that the pressure be not too great.

SECONDARY HEMORRHAGE.—This is the form of bleeding which occurs after the lapse of two or three days. It may occasionally be due to the existence of the hemorrhagic diathesis; but is more commonly owing to some ulceration of the vessel in the line of ligation, before the vessel itself has been closed by natural processes; to some sloughing of the end of the divided artery or vein, with or without sloughing of the wound itself; to some imperfection in the means employed for the arrest of the primary bleeding; or to the accidental separation of a ligature.

When it takes place in a wound that appears to be healthy, and in which the reparative process seems to have progressed in a satisfactory manner, the hemorrhage will probably be found to have come from a vessel that has been imperfectly secured, or the end of which has been irreparably injured; and under these circumstances, if the bleeding be profuse, and evidently from a large artery, the wound must be re-opened, and the bleeding orifice sought for and dealt with as in the original wound. But if, on the other hand, the bleeding is not severe, and the probabilities of the case suggest that the vessel is not large, the injured limb should be raised, and moderate pressure applied; for by such means there will be a good prospect of a successful issue being obtained. Should a recurrence of the bleeding, however, occur, and the effects of loss of blood show themselves, the wound must be re-opened, and the bleeding vessel secured. When the bleeding comes from a vessel which has sloughed with the surrounding tissues, it is better practice to secure the vessel at a distance from the wound. When, however, the bleeding takes place in a case in which an artery has been tied in its continuity, the surgeon should delay re-opening the wound unless the evidence be strong that the blood comes from the supplying or afferent trunk; since experience has fairly taught us that, in a large number of these cases, the blood comes from the lower or distal orifice of the ligatured vessel, and that, under such circumstances, it may be readily arrested by the elevation of the limb and well applied pressure. In all cases, however, when the bleeding is recurrent and persistent, the wounded vessel should be looked for, and secured either at the seat of bleeding, or, when this is either difficult or dangerous, at a higher point.

PAIN.—There is no effect of a wound or operation which varies more in degree than pain. In one case the subject of a simple wound will suffer much pain, while another individual with a severe wound will experience but little. Persons vary greatly in regard to nervous susceptibility; nevertheless pain is under all circumstances a serious symptom, and a great evil; for it tends to depress the moral and physical forces of the strongest patient, and to exhaust even to death the feeble powers of the fragile. I am convinced that I have known pain to kill.

In all wounds, therefore, operative or otherwise, it is important that pain should be guarded against, and for this object surgeons can do much by care and forethought. The wounded parts should be well protected, and so placed as to give rise to the least inconvenience or distress; the dressings, likewise, should be so regulated as to give comfort. In most wounds, and after most operations, some pain will be necessarily experienced, but, as a general rule, it will subside in the course of one or two hours. To relieve this symptom, however, it is well to give opium in some of its forms, and for this purpose, after an operation in which an anæsthetic has been used, it is an excellent plan to introduce into the rectum, before the patient becomes conscious, a suppository containing from a third to half a grain of morphia. The anodyne begins to exercise its calming influence before the effects of the anæsthetic have quite passed off, and in some instances the action of the two

drugs appears to be continuous. In other cases the subcutaneous injection of a *small* dose of morphia may be resorted to, or a full dose of the same drug may be given by the mouth. Under all circumstances, the early pain after a wound or operation is to be subdued.

When the pain is persistent and continuous, after the healing process has progressed, or perfected itself, some nerve complication may be suspected : it may be that some nerve branch has been included in the ligature placed around a vessel ; or some nerve trunk may be so involved in the cicatrix of the wound, or so bound to bone or fascia, as to be kept continually irritated, or even inflamed ; or it may be that no definite cause for the pain can be made out—when the case, for want of better knowledge, is regarded as neuralgic. When the cause of the pain can be determined, this should be removed, and when no cause can be ascertained, the surgeon may be justified in cutting down on the affected nerve, and stretching it ; or in subcutaneously dividing it, as suggested by Hancock. As constitutional remedies, narcotics may be given, with tonics such as quinine, iron, and arsenic.

MUSCULAR SPASMS.—The muscular spasms or twitchings which follow wounds, and more particularly amputations, can generally be prevented by the careful application of splints and well-directed pressure ; they should be put down as preventible sources of distress, and should be guarded against in the early dressing of the case. Well adjusted pressure, with rest of the injured part, is the one thing to be relied upon to prevent and relieve this symptom, and it rarely fails. The judicious use of narcotics should at the same time not be neglected.

DEFECTS IN THE HEALING PROCESS, AND DISEASES OF GRANULATIONS.

Defects in the healing process may show themselves in either deficiency or excess of action, or in some morbid state of the granulating wound.

DEFICIENCY OF ACTION.—In the old, and in the very feeble, whether from disease or otherwise, deficiency in the reparative power is to be expected ; since, for repair, a balance of reserved force at the bank of health is requisite, and, where such a balance is absent, the extra force required for healing will be deficient. Wounds in subjects such as these, consequently, simply fail to heal, or heal slowly, or in the worst way—the failure resulting from a want of either the right quantity, or the right kind of nutritive supply and nerve force. In wounds in which quick union is aimed at, the parts which have been brought together will simply not unite; and they will remain together only as long as they are held in position by the mechanical means employed for the purpose. In the young and in the middle aged, the same failure in repair is likewise at times seen in cases of harelip or other plastic operations in which quick union is needed for success ; the parts do not unite by primary adhesion, but gape, and granulate, and the operations consequently fail. In such patients, also, fractures sometimes fail to unite as they ought, or unite but slowly, and this may be the case even when no definite cause for the deficiency in the reparative process can be detected. In all such instances, however, there is want of power from some general or local cause, which must be detected before treatment can be rationally or successfully applied.

In wounds in which union by primary adhesion is looked for, the failure may be partial or complete. When it is *complete*, the wound must be regarded and treated as an open one, and under these circumstances the sutures should

be removed, and the surface cleansed and kept clean, and then stimulated by some stimulating dressing such as carbolized oil 1–40; terebene and oil 1–4; boracic acid lotion 1–10; boracic acid ointment 1–5; or chloral or chlorate of potassium lotion, ten grains to the ounce. At the same time, the wounded part should be placed in the most comfortable position, and in that which will be most favorable for the process of repair. The constitutional treatment should likewise be of a tonic and stimulating character, with good, abundant, though simple, food, and with wine or spirits in sufficient quantity to aid its digestion, and to enable the feeble heart to send its contents to the nerve centres, so as to give them force, and to the digestive apparatus, so as to enable it to utilize the food and get rid of effete matter. The patient at the same time should be placed in the best hygienic surroundings.

When, however, the failure in primary adhesion is not complete, but *partial*, and when there is the smallest foundation for the hope that by keeping the parts together the required repair may yet be secured, the sutures should be left in position, the wound cleansed with some medicated antiseptic lotion, and, if necessary, either another suture introduced, or some other means employed to bring and to keep the parts well together; even should failure follow the attempt to gain primary adhesion, success may follow another effort made to secure secondary adhesion of the granulating surfaces, or union by the *third intention*. Where the cause of non-union is local and only temporary, these measures will often succeed, and will turn what seemed to be a failure into a satisfactory result. In harelip and in most plastic operations, a rigid adherence to this surgery of hope and discretion is to be highly commended.

Defects of the Healing Process from Excess of Action, or Inflammation. —When excess of action takes place in a wound in which repair by primary adhesion is looked for, disappointment, in all probability, will be the result; for whenever there is in a wounded part more vascular action than is required for the reparative process to perfect its work, repair is first interfered with, then stopped, and, finally, what might have been repair becomes dis-repair, and the wound, when not held together mechanically by sutures, strapping, or bandages, gapes or opens. When excess of action, or inflammation, attacks an open wound that is granulating and cicatrizing, repair likewise ceases, and becomes dis-repair; the granulations, instead of presenting a healthy, florid appearance, and secreting a bland, creamy pus, become œdematous or glazed; what has been a granulating surface becomes an ulcerating one; and the secretion from the wound changes from pus, to a thin, serous discharge, with more or less *débris* of tissue. The thin, red, marginal line, with its cicatrizing edge extending on to the granulating surface, presents a more or less extended area of vascular congestion; this being, when the action is sthenic, red to an extreme degree, but when asthenic, tending towards blue, the redness shading off in intensity towards the blue lividity of congestion. The surrounding parts, moreover, will, under these circumstances, be tense from inflammatory effusion, hot, and painful, when the inflammation is acute; but when this is of a lower type, they will be œdematous, boggy, less painful because less tense, and less hot. When the local inflammation is sthenic, the constitutional disturbance will coincide with it in type, and the symptoms will be those of inflammatory fever; when the local action is of a low and asthenic form, the constitutional symptoms will partake of the same nature, and will approach those of low fever.

It is to be known also, and remembered, that the acute or *sthenic* form of inflammation, as a rule, attacks a wound when newly made, and is generally excited by some local cause; possibly from the original injury, more probably from some imperfection in the primary dressing, and most probably

from the retention of some irritating fluid in the depths of the wound, from want of proper drainage. This is more likely to occur in wounds of certain parts or tissues—as in wounds of joints, wounds of large cavities, and deep, punctured wounds—than in lesions of another character.

The *asthenic* form of inflammation, as a rule, attacks wounds at a more advanced period; when the first effort at natural repair has been made, and has more or less succeeded, and when it might seem as if the effort to repair the part, and the power to effect that repair, were not commensurate. At any rate, in the treatment of these two forms of inflammation, when attacking wounds, it will be safe to assume that such is the fact; for while in the acute or sthenic variety, a local cause for its production should be looked for, in order that it may be remedied—in the asthenic, or later kind, the recognition of the fact that the inflammation is due to a deficiency of general power, is all important.

Treatment of Inflammation Affecting Wounds.—In the sthenic form of inflammation, the local and general action is to be subdued by giving free vent to pent-up fluids; by the local employment of ice, or of some other means of applying cold; by the local abstraction of blood; and by free purgation. For the latter purpose, there is nothing better, after a good purge, than repeated small doses of a saline cathartic, such as Epsom salts. When suppuration takes place, it must be actively dealt with.

In the asthenic form, general tonics, with stimulants and nutritious food, are essential; and locally, absolute cleanliness, the free exposure of the wound for purpose of drainage, with, possibly, warm medicated irrigation, and the constant use of such stimulating antiseptic applications as the nature of the case may suggest. Cold, locally applied, is rarely beneficial.

DISEASES OF GRANULATIONS.—When an open wound heals, or a cavity fills up with reparative material, it does so by a process of granulation; and when this process takes place in a healthy subject, and under favorable conditions, the granulations present certain appearances, and are known as healthy granulations. When, however, the same kind of repair is being effected in a feeble or diseased subject, or under circumstances which are not favorable for its progress, the granulations present different appearances, these being, as it were, *pathological*, in contradistinction to those which are seen when the ordinary *physiological* process of repair is being carried out; a process which is very closely allied to, if not identical with, that of development and growth.

In a *healthy* granulating surface, the granulations appear as small, conical masses of granulation tissue, covered with a thin layer of pus cells. The granulations are of a bright, florid red color, and are fringed at their skin border with the well-known, thin, blue line which is so indicative of healthy "skinning" or cicatrization; and during the whole of the healing process, this appearance is maintained, the only visible change being the gradual diminution of the granulating surface by the steady approach of the thin, blue line towards the centre. Some wounds undergo contraction at the rate of from one to one and a half inches a week. The skin around a healthy granulating surface will be healthy.

In these granulations, and in their different appearances under diverse circumstances, the educated eye of the surgeon can rapidly read, not only every important change in the bodily condition of the patient, but almost every variation, from day to day, in the patient's condition, for a granulating surface is, as I have been in the habit of describing it, a kind of weather glass or barometer of health; the surgeon cannot only read in it, as long as it maintains its healthy aspect, that the man who bears it is healthy, and that his different systems—nervous, secretory, and excretory—are doing their duty in a normal

way; but he will be able to recognize in the changed appearance of the granulations themselves, and of the thin blue line of cicatrization, the slightest deviation from the healthy type; for while it is true that, as long as a granulating surface is healing kindly, the inference is correct that the subject of the "sore" is healthy; it is equally certain, when the granulating surface has deviated from the healthy path, that there is something wrong, either in the patient, in the part itself, or in its treatment.

Thus, in a patient who is anæmic, the granulations will be pale and bloodless; and when this condition has been of long standing, they will lose their small conical form, and appear as coarse, watery elevations. When there is any interference with the return of the venous blood from the granulating part, from either heart disease, the dependent position of the limb, or the improper use or bad application of bandages or other mechanical appliances, the granulations will appear *congested* to variable degrees, and may even bleed; they may be so congested and full of venous blood as to put on the purple appearance which suggested to the old authors the name of the "juniper ulcer," the granulations being so full of venous blood as to appear as blue or black as a juniper; the sore is then, clinically, said to be *congested*. When it bleeds it is generally called *hemorrhagic*.

When from some constitutional or local cause the reparative process is acting feebly, the deficiency of action may be seen in the granulations, or rather in the sore—for under these circumstances the surface of the sore will either present a few ill-formed and feeble granulating spots, or it will appear smooth and apparently deficient in granulations altogether, and will look to the eye not unlike the tense mucous surface of the pharynx. In other cases, the reparative force may be too feeble to express itself in any granulating process, and the sore may present a greenish, dirty-colored surface, discharging an acrid or putrid substance which is clearly blood and serum mixed with the decomposing elements of dead tissue, the ill-formed granulations or granulation-tissue dying superficially, as soon as formed, for want of power to live and develop. In more extreme cases of deficiency of power, what may have been a reparative process not only ceases to be so, but becomes retrograde; what had been a *constructive*, changes into a *destructive* force, and the tissues that should have been repaired break down and undergo molecular disintegration, the sore, instead of healing, becoming an ulcer, and the new tissue dying from want of vitality. At times, when the reparative power is feeble, and yet granulations form, these will present a corresponding appearance; that is, they will have a pale, watery, œdematous character, and the discharge from them will not be normal pus, but a sero-purulent fluid; the granulations that form are of a weak type, and the sore then constitutes a *weak* ulcer.

On the other hand, excess of action may at times affect a granulating or healing sore, and, when it does so, it affects the granulating process as much as it has been shown to do a wound in which quick union or primary adhesion is sought for. In the stage of irritation, or that in which the granulation-tissue is simply over-stimulated, over-action shows itself in an excess of secretion from the granulating surface, in the shape of pus, and probably in some increase in the size and redness of the granulations themselves; and when this is other than a passing condition from some temporary cause, it will soon pass into one of inflammation.

When inflammation attacks a granulating sore, changes will occur similar to those which have been described as taking place when it affects a healing wound.

Physiologically, there will be an arrest of the healing process, an arrest of secretion from the granulations, and, if the action be lasting, a change from

what had been a healing process to one of ulceration. The ulceration will be more or less rapid, and associated with all the local and general phenomena of inflammation, such as redness and heat of the margins of the sore and the adjoining tissues, with pain and swelling. The degree and character of the inflammation regulate these appearances; an inflamed sore or granulating surface presents as many different aspects as there are degrees or kinds of inflammation, for inflammation must be regarded as an accidental complication of the sore, and it may attack it at any stage of its progress, or in any condition. At times, the granulating force may be in excess, and so act as to prevent repair. The granulations sprout above and beyond the margins in which the " cutifying" action is carried out, and appear either as elevated, luxuriant granulations in the centre of a sore or at the orifice of a sinus, or as overhanging, florid granulations at the cicatrizing border. In these cases, there is simply an excess of granulating force, and this excess exhibits itself in fungous granulations.

Again, a granulating wound, when of long standing, may show on its surface, or in its surroundings, evidence of the existence of any constitutional or specific condition. That is to say, a chronic sore, in a patient who has a syphilitic taint, may present features by which the presence of the syphilitic poison can be recognized; and a chronic sore, in a scrofulous subject, will manifest conditions which, if not special, as in the syphilitic, will be clear enough to indicate sufficient feebleness and torpidity of action to suggest the existence of some general dyscrasia.

THE ANTISEPTIC METHOD OF TREATING WOUNDS.

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ORIGIN OF THE ANTISEPTIC METHOD.

THE title of "THE ANTISEPTIC METHOD" was given by Mr. Lister to a form of wound treatment founded on certain definite principles, and commenced by him in 1865. For several years previously he had been impressed with the great evils which resulted from the putrefaction of discharges in wounds, and though he had succeeded in many ways in lessening the occurrence of putrefaction, yet it was not till after he had examined the results of Pasteur's researches on spontaneous generation, and on the causes of fermentations, that he was able to systematize his work. Up to this time, scientific opinion, more especially in England, had been divided between two views with regard to the occurrence of fermentation, the one asserting that this process was due to the action of the gases of the air, and particularly of the oxygen, on the discharges, and the other asserting that fermentation was a spontaneous alteration, occurring in organic fluids after their exit from the tissues and vessels, and that it was a necessary consequence of loss of vitality.

As long as these views were current, there was not much hope of entirely eradicating putrefaction in wounds, and its consequent evils. The effort to exclude the gases of the air had been made by several surgeons, and had entirely failed to do any good. Most prominent among the surgeons who had used the so-called "occlusion" method, with the view of arresting the putrefaction of the discharges of wounds by preventing the entrance of atmospheric gases, was Jules Guérin, of Paris. Starting with the good results which followed subcutaneous operations, he attributed these to the avoidance of putrefaction in the wound, or at least to the exclusion of the atmospheric gases from it. He therefore carried on an elaborate series of experiments with the view of excluding the gases of the air from wounds, but without any good result. He sealed up wounds with various materials, especially with gold-beater's skin, but the result was more frequently tension and inflammation in the wound, than the absence of fermentation and a subcutaneous healing. In later years, he tried other means, and at length introduced a special apparatus by means of which the air was pumped away from the vicinity of the wound. Nevertheless putrefaction and its consequences still occurred. Various other attempts have been made on the same principle, and these have in like manner failed. Thus the wound has been covered with collodion, so-called styptic colloid, etc. Leconte and Demarquay substituted other gases, more especially carbonic acid gas, for air, but their method was quite impracticable on a large scale, while it did not prevent fermentation.

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While these attempts to prevent putrefaction by excluding the gases of the air were being made, indeed before they had been thought of, it had been found that the addition of various substances to organic fluids, whether outside the body or in wounds, had a marked effect in retarding or preventing fermentation, and notably in preventing smell. These substances therefore received the name of "antiseptics"—substances which prevented putrefaction, or, literally, which acted against the causes of putrefaction. These had been in use for a very long time, chiefly in the form of various balsams, ointments, or lotions. The most efficacious balsams contained various essential oils, which we now know to be powerful antiseptics, while the best lotions had, among other substances, alcohol as their chief component. The treatment of wounds with antiseptics had, however, been carried on in a very desultory manner, and without any fixed guiding principle, till the publication, in 1859, of a paper by Corne and Demeaux on a paste containing coal tar. By means of this paper, the attention of French surgeons was at once attracted to the whole question of the use of antiseptics in the treatment of wounds, and for a year or two very fertile results were obtained. Lemaire more especially took the matter up, and after experimenting with an emulsion of coal tar, with very good results, he at length found that carbolic acid was the chief antiseptic constituent in coal tar, and accordingly introduced it into surgical practice. During the same time, various other antiseptics were brought forward, of which alcohol, in the practice of M. Nélaton, yielded the most important results. As the result of Lemaire's writings, the use of carbolic acid spread very rapidly on the continent, and even in Great Britain a few surgeons (Spence, Wood, etc.) employed it somewhat extensively. Carbolic acid, as used in this way, has, however, many disadvantages, and hence many who had at first employed it largely, gave it up almost entirely, and it seemed likely to fall into disuse, until it was again brought into notice by the writings of Prof. Lister.

All these attempts, however, with the exception to some extent of Lemaire's, were merely empirical, or at least founded on no definite theory of the causes of fermentation. Consequently, the modes in which the antiseptics were used were very various, and as a rule very inefficient. What, perhaps, more than anything else, tended to confuse the minds of surgeons on this subject, was the success of what was apparently a very different method of treatment, and one opposed to any of the existing conceptions of the origin of fermentations. So contrary was it to the views of the majority of surgeons at that time, that great doubts arose in the minds of some whether, after all, putrefaction in wounds could be the evil which it had seemed to be. I refer, of course, to the open method of treating wounds.

THE GERM THEORY.

In the mean time, however, science was making rapid advances in this department, more especially by the labors of Schwann, Schroeder and Dusch, and Pasteur. The theory that fermentation was due to the gases of the air had become untenable. Organic fluids which had been sterilized by boiling, could be preserved for an indefinite time in the presence of air which had been previously heated (Schwann), which had been passed through sulphuric acid (Schulze), which had been passed through water (Pouchet), which had been filtered through cotton-wool (Schroeder and Dusch), or which had simply been allowed to remain at rest for a sufficient time to permit the solid particles suspended in it to settle (Pasteur). It was also shown that no gas, *per se*, had any power of causing fermentation. Pure oxygen, nascent

oxygen, ozone, exhalations from putrefying materials, could be brought in contact with organic fluids and substances without setting up any fermentative changes in them. The cause of fermentation was certainly not the gases of the air, and, in the case of boiled organic fluids and tissues, it was something particulate; something floating in the air, but removable from it mechanically, by filtration, etc.; and destructible by various chemical agencies, such as sulphuric acid, heat, etc. It was thus evident that all attempts at excluding merely the gases of the air from wounds, could not but be abortive, for the gases were not the causes of the putrefaction in the discharges in wounds, and were not even an essential condition of that change; and that their exclusion, therefore, even if thoroughly effected, did not imply the exclusion of the causes of fermentation, or indeed its arrest in any way. The clinical experience of Guérin and others absolutely confirmed this conclusion.

While it was thus established that the fermentation of boiled organic fluids and substances was due to the entrance of dust from the outer world, and not to the action of the gases of the air, or to any change inherent in the fluids or substances themselves, facts were being gradually accumulated which tended to show that unboiled organic materials, among which of course we reckon the discharges from wounds, obeyed the same law; and at the present time this view has been firmly established.

One or two very simple facts will suffice to illustrate this point. Take Mr. Lister's experiment with unboiled urine. The orifice of a flask is covered with a cap of cotton-wool, and the whole is placed in a suitable chamber, which is raised to a temperature of 300° F., and kept at that temperature for a sufficient length of time to destroy any living material in its interior (two to three hours). This heat acts on the air and the dust in the interior of the flask, in the same way that the air is acted on when passed through an iron tube heated to redness, as in Schwann's experiment; the dust is rendered incapable of setting up fermentation. By means of the cotton-wool cap, the air which enters the flask during cooling is filtered of its dust, just as in Schroeder and Dusch's experiments. The glans penis is then washed with 1-40 carbolic acid lotion, which acts in the same way on any causes of fermentation which may be present there. The cotton-wool cap being now rapidly removed, the glans penis is at once placed over the orifice of the flask, and urine is passed into the flask. As soon as the glans is removed, the cotton-wool cap is reapplied, and the flask containing unboiled urine in contact with filtered air is set aside in a warm place. This urine remains pure for an indefinite time, though, if dust be introduced into it, fermentation takes place rapidly. Here we have exactly the same law at work as in the case of boiled organic fluids; the gases of the air cannot cause fermentation; fermentation is not a spontaneous change in the material experimented on; it only occurs when solid particles, removable by heat, filtration, etc., are admitted. I have been able to make out similar facts with regard to tissues removed from the bodies of healthy animals, facts which are further of importance in proving that the particles which cause putrefaction are not normally present in the healthy living body. Take a vessel, cover its orifice with cotton-wool and heat it as before described; then introduce into it some sterilized organic infusion, taking sufficient precautions to prevent the entrance of septic dust; lastly, with various precautions[1] to render any air-dust innocuous, remove portions of the organs from the body of a healthy animal which has been just killed, and introduce them into one of these prepared vessels. The result is, if the experiment has been properly conducted, that many of the tissues of the body may be preserved unaltered for a long time, showing that there are no causes of fermentation present in them, and that they have no inherent tendency to undergo such a change.

As soon as it was clear that fermentation was due to the access to the fermentescible substances of particles from the outer world, and that these

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[1] For further details, see a paper " On the relation of micro-organisms to antiseptic dressings," in the Transactions of the Pathological Society of London, for 1879.

particles were destructible by heat and chemical agencies, a possibility of preventing fermentations in the discharges of wounds was opened up, and it was this idea which Professor Lister seized on, and the development of which has led to such fruitful results.   A vast number of observations and experiments had shown that there was a very intimate relationship between fermentations in wounds and the constitutional disturbances so apt to follow them, a relation to some extent of cause and effect, and it was quite clear that if the occurrence of these changes could be prevented, a vast advance would be made towards the abolition of the so-called septic diseases.   Mr. Lister's aim has all along been to destroy the fermenting power of these particles before they reach the wound, and thus at once place the patient out of danger from any of the consequences which are supposed to be connected with a putrid or fermenting state of the discharges.

Principles of the Antiseptic Method.

While for the practice of the Listerian method it is only necessary to know that the causes of fermentation are *particles*, which reach the fermentescible substance from the outer world, and that these particles are destructible by various chemical means, yet it is of importance to ascertain more definitely what is the nature of these particles, and this knowledge will be found to open up a wider meaning of the term antiseptic surgery than is generally understood.   It has been known for several years that in all fermenting fluids low forms of vegetable life are present, forms which are included in a class termed *Schizomycetes*, or more popularly known as *Bacteria*.   It has also been amply demonstrated that these micro-organisms do not arise *de novo* in these materials, but that they are always derived from a parent.   It has further been shown that they enter fluids and tissues from the outer world, being present as particles in suspension, in air, water, etc., or being deposited as dust on surrounding objects.   It is also evident that as these bodies are living, they must acquire materials for their growth from the substances in which they grow; they must breathe, take in food to build up and renew their protoplasm, and excrete waste products.   It thus follows that the material which serves them for food must undergo a change as the result of their growth; and, since the result of the growth of individual cells in the complex animal organism is the formation from the blood of certain definite substances, there is nothing unreasonable in supposing that the result of the growth of cells floating free in a fluid, will be the formation of certain definite substances, varying according to the nature and function of the cell.   In other words, the chemical substances forming the pabulum of these vegetable cells will undergo a constant and definite series of changes, which we know by the name of Fermentation.

As we have already seen, fermentation is due to the entrance into the fermentescible material of particles from the outer world.   The origin of micro-organisms in similar substances is also due to the access of particles from the outer world.   Micro-organisms are always present in fermenting fluids.   Micro-organisms must produce a change which comes within the definition of "Fermentation," as the result of their growth in these materials.   The precautions which exclude micro-organisms from organic substances also exclude the particles which cause fermentation.   Where one set of particles is admitted, the other also enters; one cannot get fermentation without the presence of micro-organisms, nor the presence of micro-organisms without fermentation.   The fermentations of which we speak are not instances of chemical decomposition; they do not correspond to the change produced by ptyalin, pepsin,

etc.; the ferment increases in quantity, and the fermentation takes a considerable time to be completed; it is evidently a vital phenomenon. These facts of themselves would surely lead to the conclusion that the particles which give rise to micro-organisms, and those which cause fermentation, are one and the same; that in fact fermentation is the result of the growth of micro-organisms in fermentescible materials. Numerous facts show that this is so, but into the consideration of these I need not enter. It is now universally admitted that the *alcoholic* fermentation is due to the growth of the yeast-cell in the sugary solution, and that the formation of *vinegar* is due to the growth of the so-called " Vinegar plant." Numerous similar facts have been demonstrated with regard to other fermentations. The formation of numerous pigments on boiled potatoes and other suitable soil, is due to the growth of forms of micrococci and bacilli; and the same is true of blue milk, blue pus, etc. Pasteur has brought forward remarkably interesting facts with regard to the *butyric* fermentation. Mr. Lister has absolutely demonstrated that the *lactic* fermentation of milk is due to the growth of a special form of bacterium in the milk.[1] Numerous experiments have also been performed which demonstrate that the *putrefactive* fermentation is no exception to the general law, and that it also is due to the growth of micro-organisms.

Antiseptic and Aseptic Surgery.

Since, then, the fermentation of the discharges of wounds is due to the growth in them of micro-organisms, which bodies come from the outer world, it is evident that surgery which acts against the causes of fermentation, that is, Antiseptic Surgery, may be carried out in various ways. It is not merely confined to the *exclusion* of organisms, but it may work by permitting their entrance, and neutralizing their power afterwards. This is the most common way in which antiseptics are employed at the present time. They are added to the discharge, and their usefulness depends on the extent to which they interfere with the growth and fermenting power of the micro-organisms which have entered the discharge, without at the same time being hurtful to the wound. The latter is an important point, and it is for this reason that carbolic acid is one of the least satisfactory antiseptics when employed in this way. For it irritates the wound, thereby giving rise to increased discharge; while, on the other hand, it requires to be present in large amount, in albuminous materials, in order to arrest or materially interfere with fermentation. The former effect of carbolic acid defeats the latter aim, and thus, where carbolic acid has not been used *aseptically*, that is, with the view and with the result of excluding micro-organisms from wounds altogether, it has been found to be inefficient, and by no means a satisfactory application. The free *drainage* of wounds is also an antiseptic method, for by it the discharge is carried away from wounds before micro-organisms have time to develop in it, or to alter it to any extent. At the same time, it is a method liable to fail if anything interferes with the drainage, for as the causes of fermentation are constantly present, they develop, if for any reason the discharge collects in the wound. Among the most important antiseptic measures is treatment by *irrigation*, or by the *water bath*. In treatment by irrigation, the discharge is not merely permitted to flow away, but it is washed away as fast as it forms, and thus there is less chance of development of micro-organisms than where free drainage alone is employed. The antiseptic virtues of this method are much increased by using an antiseptic lotion for irrigation. Treatment by the water

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[1] Transactions of the Pathological Society of London, 1878.

bath can hardly be as effectual as by irrigation, for the discharge is not re-
moved with the same certainty and rapidity. The *open method* of treatment
must also be included among the antiseptic methods, though at first sight it
might appear entirely opposed to them.

The free exposure of the discharge to the air acts antiseptically in two
ways. In the first place, it was pointed out by Pasteur long ago, with regard
to the alcoholic fermentation, that the fermenting power of the yeast cells was
much diminished if they were freely supplied with oxygen. On the other
hand, if they had but little oxygen, they, according to his theory, took it
from the sugar, and caused fermentation much more rapidly and thoroughly.
Therefore, any micro-organisms requiring free oxygen for their growth,
though they grow more rapidly, will produce less fermentation, if the dis-
charge be well oxygenated, than if it be shut up under a mass of dressings.
But Pasteur also showed, with regard to the butyric and putrefactive fermen-
tations, that oxygen was directly noxious to the bacteria which caused them;
that not only could these fermentations not occur if oxygen were freely ad-
mitted, but that the bacteria were actually killed by this gas. Thus the free
exposure of the discharge to oxygen diminishes the fermenting powers of
those micro-organisms which grow in it, while it prevents the development of
those which cause one of the most obnoxious fermentations—the putrefactive.
In the second place, the open method acts antiseptically in another way.
For by the free exposure of the discharge to the air, evaporation takes place,
and the fluid becomes more concentrated. Now bacteria do not develop nearly
so well in a concentrated as in a moderately dilute solution, and fluids may
be made so concentrated that bacteria will not develop in them at all. This
concentration of the fluids is carried to its most complete extent in the treat-
ment by crust formation, and it acts to some slight extent in Alphonse Gué-
rin's cotton-wool dressing, though that hardly deserves to be included among
antiseptic methods. A very different, but equally important principle is in-
volved in the method of treatment by accurate approximation of cut surfaces,
and the maintenance of perfect mechanical rest. It is well known that
wounds of the face unite readily by first intention, without the occurrence of
fermentation in the layer of lymph or blood-clot between the cut surfaces.
This implies one of two things: either lymph is a medium in which micro-
organisms can only develop with difficulty, or else the healthy living tissues
have the power of preventing the development of micro-organisms in their
substance and immediate vicinity. That the latter is the case, has now been
amply demonstrated, and it is the chief agent at work in getting this result.
At the same time, lymph is not by any means the best pabulum for isolated
bacteria.

Aseptic Surgery and Listerism.

It is, of course, at once evident that all these methods must stand far below
the great principle which Mr. Lister was the first to enunciate, and to the
application of which in surgical practice he has devoted so many years. When
Mr. Lister first wrote on this subject, the confusion and uncertainty which
existed in the minds of surgeons on this matter, was, as I have just indicated,
very great, and the results obtained by him in all cases stood forward in glar-
ing contrast to the results got at that time from the misdirected efforts of
other surgeons. Since he wrote, however, and to a great extent by his own
writings, interest has been excited in this department, and improvement has
followed, not merely in the method of treatment which he devised with the
view of excluding micro-organisms altogether from wounds, but also in the
less perfect forms of antiseptic surgery to which I have referred in the preced-

ing paragraph. Indeed, so good have the results become in ordinary cases treated antiseptically by one or other of the methods mentioned, though not *aseptically* (that is, on the Listerian principle),[1] that some surgeons are in-inclined to the view that aseptic surgery is unnecessary in a great many cases, being only required for certain special operations. This view is, however, erroneous and mischievous, for by no method other than the aseptic method have infective diseases been entirely abolished; in cases treated by other forms of antiseptic surgery, they occur every now and then, and the surgeon cannot leave their possible occurrence out of account in determining the expediency of an operation. That certain operations are only justifiable when full precautions are taken to exclude micro-organisms, is now admitted by all. Such operations are incisions into joints, opening of psoas abscesses, operations on healthy bones—as for ununited fracture, etc. That such operations are perfectly safe when done with proper aseptic precautions, is also abundantly proven. As the aseptic method can protect the patient under these circumstances, it can also protect him in ordinary cases, and, therefore, if one desires to be perfectly certain of avoiding infective disease in any given case, he must employ the aseptic method. But as it is the duty of the surgeon to prevent every possible risk in every case, it is, therefore, his duty to employ aseptic treatment whenever he can. And even supposing that the other methods were perfectly reliable in ordinary cases for the purpose of saving life, there are other advantages in the aseptic method which require its employment. By its use the patient is often saved a great amount of pain, and healing is very rapid and certain; while, on the other hand, patients treated in other ways, if they do recover, often do so only after a severe struggle for life. Many other advantages might be mentioned, but these I need not detail here.[2]

In speaking and thinking on this subject, great care must be taken to distinguish between ASEPTICISM and the ASEPTIC METHOD. Asepticism is synonymous with Listerism; it is the great principle, first enunciated by Mr. Lister, that the causes of fermentation in wounds are particles from the outer world, and that in order to abolish the risks due to fermentation in wounds, the proper method of treatment is to prevent the entrance of the living causes of fermentation into them. The aseptic method is synonymous with the Listerian method. It is the best way at present known of securing this result. When, as of late has happened, Mr. Lister gives expression to the view that perhaps the time is not far distant when some of the means at present employed in his method may be abandoned, the cry is raised that "Listerism is dead." Such an idea rests on mis-appreciation of what Listerism is. Listerism or asepticism is a great principle which has triumphantly withstood the most searching tests, and which is now a law of the first importance to the practical surgeon. The Listerian or aseptic method is the best means at present known of carrying out that law in surgical practice, but the means have always been improving, and must always continue to improve. The time may indeed come when the method shall have undergone an entire alteration, but, nevertheless, the principle underlying it will always remain the same. Whatever changes may occur in the present Listerian method, Listerism will always remain the most fundamental prin-

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[1] As will be evident from what has gone before, there are a variety of forms of *antiseptic* surgery, that is, of wound treatment directed against the causes of fermentation, and the method used by Mr. Lister for the total exclusion of micro-organisms, is only one form. To retain the term " antiseptic surgery" for this method alone, is to introduce confusion, and it seems better, therefore, to abandon it, and to speak of Mr. Lister's method as the *aseptic* method, for it aims at, and succeeds in, excluding the causes of fermentation altogether from the wound ; that is, it renders the wound *aseptic*.

[2] For full details on these and other points, see my work on "Antiseptic Surgery ; its Principles, Practice, History, and Results." London, 1881.

ciple of wound treatment, and the surgeon when he makes a wound will "lister" it in the fullest sense of that term. The same thing has occurred with all natural laws; when once discovered and firmly established they remain immutable, but the practical applications of them are constantly widening and improving.

As the other methods of antiseptic surgery have already been detailed in a preceding article, it only remains for me to describe the best means at present at our disposal for carrying into effect the great Listerian principle. At first the means employed were quite simple: some pure carbolic acid was poured into the wound, and, mixing with the blood, formed a crust; or the crust formation was assisted by the addition of lint; and under the protection of this crust the wound healed. Numerous disadvantages were found in this method, and many alterations and additions were made, till at length the present form was established, and has been employed satisfactorily for several years.

The Aseptic Method.

In order to have an aseptic state of a wound, a number of points must be attended to. In the first place, during the performance of an operation care must be taken to prevent the entrance of organisms. The skin of the patient is everywhere covered with dust which contains numerous active causes of fermentation. These must, therefore, be destroyed, as otherwise the operation would be entirely vitiated. On the hands of the surgeon and his assistants there are also numerous causes of fermentation, which must also be removed. The same is the case with all instruments, etc. Sponges must not be washed in water: indeed water contains perhaps more numerous causes of fermentation than ordinary air dust, and therefore it must not be employed at all. And the air itself, though in a much smaller degree than the deposited dust, contains some causes of fermentation which must also be guarded against. Then, after the operation has been performed, care must be taken to prevent the access of micro-organisms; this is done by the use of a suitable dressing, which imparts to the discharge, as it flows out, sufficient of the antiseptic stored up in it to render the discharge an unfit soil for the growth of micro-organisms. After a time the antiseptic contained in the dressing becomes exhausted, and must be renewed. When this is done, the same care must be taken not to introduce any septic dust as during the operation.

The antiseptic which has been chiefly employed up to this time, and which has proved most satisfactory, is *carbolic acid*. For the purification of the skin, either of the patient or of the operator, a watery solution, of the strength of one part of the pure acid to 20 parts of water, is employed. The skin over, and in the neighborhood of, the intended wound, is thoroughly washed with this solution, which must be allowed to act for some little time, because the antiseptic has to mix with the fatty matters, and to penetrate into the folds of the skin, while at the same time some of the micro-organisms may be peculiarly resistant, and may require a considerable time for complete destruction. In cases in which poultices have been employed, or in which there is an accumulation of putrid material on the skin, it is well, after washing the skin thoroughly with this lotion, to wrap a cloth soaked in it around the part, and leave it on for fully half an hour before the operation.

For the purification of the *hands* of the surgeon and of his assistants, in the first instance, if the operation be an important one, as, for example, on a joint, or opening an abscess, it is well to use the same strong solution of carbolic acid, and care must be taken that the whole hand is thoroughly washed

with the solution.   It is not sufficient merely to *dip* the tips of the fingers or even the whole hand in the solution ; care must be taken that all the folds of skin, more especially about the nails, be acted on, and particularly that the solution pass up under the nails.   In ordinary wounds, the 1–40 watery solution of carbolic acid is sufficient, and it does not benumb the hand, as the stronger solution is apt to do.

For the purification of the *instruments*, the 1–20 solution is employed.   A large porcelain or tin trough is provided ; the instruments to be employed are laid in this, and then it is filled with 1–20 solution.   In hospital practice, this is generally done from a half to one hour before the operation takes place. When toothed instruments, or instruments closing with catches, are used, it is best to separate the blades, so as to allow the lotion to get in between the teeth.   It is well to immerse the whole of the instrument, for if only the point, for example the blade of a knife, is purified, the surgeon may inadvertently introduce the handle into the wound without washing it with the solution, and he may thereby introduce septic dust.

The *sponges* are washed in the 1–40 carbolic solution.   After the operation, they are rinsed in water, and then placed in a jar of 1–20 solution till required again ; then the 1–20 solution is squeezed out, and the sponge, when washed in the 1–40 lotion, is ready for use.   These sponges may be used for a long time, till, in fact, they wear out.   In some cases they get clogged with fibrine.   To get rid of this, the sponge is placed in a trough containing water, and left for some days.   The fibrine putrefies, and can then be washed out readily.   The sponge is then placed in a jar containing the 1–20 carbolic lotion, and is ready for use when required.

The purification of the air is effected by means of a *spray* of carbolic acid. The spray is produced by driving a rapid current of air through the narrow orifice of a horizontal tube, which is placed over the orifice of a more or less vertical one.   The air rushing over the opening in the vertical tube, sucks the air out of that, and, if the lower end dips into a fluid, the fluid is sucked up and expelled from the narrow orifice in the form of finely divided particles, or spray (Fig. 216).   At present, steam sprays are employed.   They consist

Fig. 216.   Fig. 217.
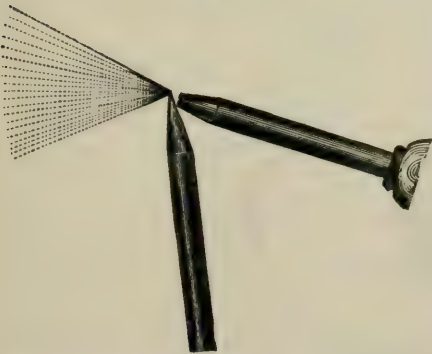
Diagram to show the principle of spray producers.   Ordinary steam spray producer as at present
employed by Mr. Lister.
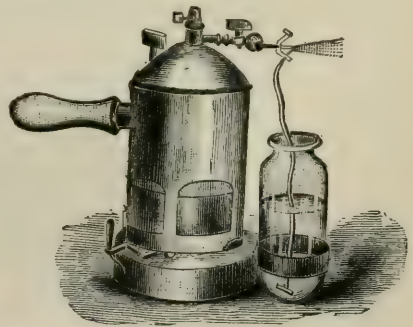
of three parts : a boiler, containing water ; a lamp, placed beneath this boiler ; and a retort, containing carbolic lotion.   The steam generated in the boiler passes along a horizontal tube, sucks up the lotion through a vertical tube connected with the retort, and, mixing with it, forms the spray (Fig. 217). The fluid in the retort is the 1–20 watery solution of carbolic acid, and this,

mixing with the steam, forms a spray of the strength of about 1 part of car-
bolic acid to 30 parts of water.   The spray is employed during the whole
operation ; till in fact the dressing has been securely applied.

With the view of excluding organisms after the operation, the material
usually employed is the *carbolic gauze*.   This is ordinary tarlatan, impregnated
with a mixture of 1 part of carbolic acid, 4 parts of resin, and 4 parts of
paraffin.   If the cotton material were merely dipped in carbolic acid or car-
bolic lotion, the antiseptic would very quickly volatilize, or be washed out by
the discharge.   It is necessary, therefore, to have the antiseptic stored up so
that it may last for some time.   This is the purpose of the resin.   Resin and
carbolic acid have a much greater affinity than water and carbolic acid.
Water, therefore, may pass over a mixture of resin and carbolic acid for a
considerable time, without washing out all the antiseptic.   If the gauze were
impregnated with resin and carbolic acid alone, it would be so sticky as to be
useless, and therefore paraffine is added to it in sufficient quantities to do away
with its stickiness.   As the gauze at ordinary temperatures does not give off
much carbolic acid, dust which falls on it is not deprived of its fermenting
property, and, if a piece of gauze covered with dust is applied over the ori-
fice of a drainage tube, this dust may pass into the wound, and entirely defeat
the object of the whole treatment.   On the other hand, the watery solution
of carbolic acid acts very rapidly, and hence all that is necessary is to dip
the layers of the gauze which go next the wound in the 1–40 lotion.   Lest the
carbolic acid should evaporate, the gauze, if it is to be kept for some time,
is preserved in closely-shutting tin boxes.

Carbolic acid is a powerful irritant, and, applied directly to a wound, it will
retard or even prevent healing.   With the view of overcoming this difficulty,
Mr. Lister interposes a material, impervious to carbolic acid, between the
wound and the gauze dressing.   This material is termed the *protective*.   It is
ordinary oiled silk, coated on both sides with a thick layer of copal varnish.
Outside this a solution of dextrine is brushed, because water runs off from
the material without the dextrine, just as from a duck's back, whereas the
dextrine dissolves in the lotion, and the protective is equally and perfectly
moistened.   This protective is cut a little larger than the wound, dipped in
the lotion, and applied over it.   Outside the protective we have the wet
gauze, larger than the protective and overlapping it in all directions, both
together being called the *deep dressing* (Fig. 218).

Fig. 218.
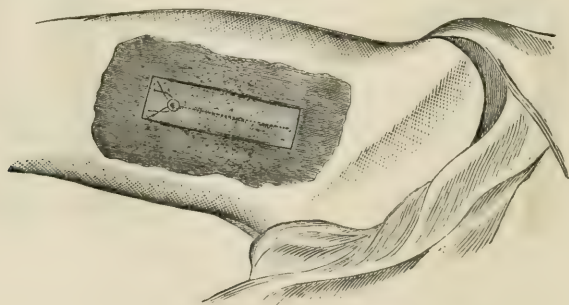
Shows the method of using the protective and deeper layer of the gauze.

When used as a dressing, the carbolic gauze is packed into the hollows
around the wound, and then a regular dressing is applied.   This consists of the
gauze folded in eight layers, beneath the outer layer of which is placed a piece

of *mackintosh* cloth, what is known as " hat lining." The object of this is to make the discharge traverse the whole of the dressing, and not pass directly through, as would be the case were the mackintosh absent. If there were no mackintosh, the discharge, always passing through one part, would wash out all the antiseptic in a very short time, and putrefaction would rapidly occur. To avoid this risk a large quantity of gauze would be necessary, and this would increase the expense of the treatment very much, whereas, by the use of the mackintosh, the discharge is made to pass from the centre to the edge of the dressing, that is, through a mass of gauze equal in thickness to the distance from the centre to the edge of the dressing. The same piece of mackintosh may be used several times, till in fact it wears out. After the dressing has been removed, it is taken out, sponged with carbolic lotion, and introduced into the new dressing. A patient is provided with two pieces at the commencement of the case, and these are generally sufficient, one being made up in a fresh dressing while the other is being used. Thus, though an expensive material, yet when divided over a number of dressings, its expense becomes very little. Expense is also saved by preserving the large pieces of gauze used in the dressings. They may be washed and recharged with the carbolic acid mixture. These dressings should be large, and should overlap the wound for a considerable distance in every direction.

The dressing is fastened on by a *bandage*. This may be made of carbolic gauze, which is light, cheap, and useful in many ways. But a cheaper bandage and one sufficiently convenient, indeed more convenient than the carbolic gauze bandage in many cases, may be made of thin muslin. As the dressing may not remain closely applied to the skin during all the movements of the patient, more especially in the neck, chest, or groin, there is a certain risk that air unacted on by the antiseptic may pass under the dressing and reach the wound, carrying active septic dust along with it. This danger is obviated by applying an *elastic bandage* along the edge of the dressing (Fig. 219). This

Fig. 219.
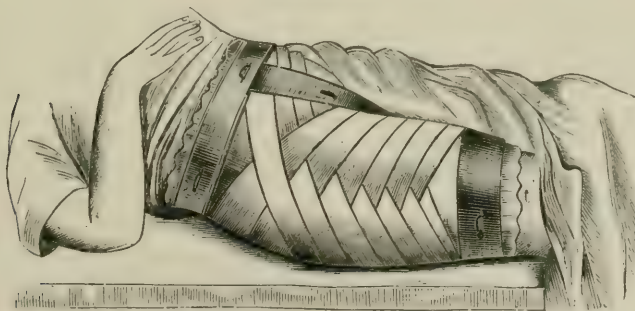
Dressing in a case of abscess of the hip-joint, showing the extent of the dressing and the arrangement of the elastic bandage around its edges.

may be put sufficiently on the stretch to keep the edge of the dressing accurately in contact with the skin, without pressing injuriously, or interfering with the circulation in the part. Pins are put in along the edge of the dressing, fastening the dressing and the bandages together at the important points. Safety pins are the best for this purpose, as common pins are apt to get buried and lost in the gauze.

Application of the Aseptic Method to Operations.

Let us now suppose that an operation is about to be performed with aseptic precautions.   The following materials will be necessary :—

(1) One to twenty and one to forty watery solutions of carbolic acid ;

(2) A trough containing the instruments, which are soaking in the 1–20 carbolic lotion ;

(3) Sponges ;

(4) Basins containing 1–40 carbolic lotion in which to wash the sponges ;

(5) Vessel containing 1–40 carbolic lotion, for use during the operation, for the repurification of hands or instruments ;

(6) Towels soaked in 1–20 carbolic lotion.   Mackintoshes.

(7) A largish piece of muslin soaking in 1–40 carbolic lotion, and termed the " guard ;"

(8) A basin containing 1–40 carbolic lotion, in which a piece of protective and loose gauze are soaking ;

(9) A steam spray apparatus ;

(10) A vessel containing 1–20 carbolic lotion, for the purification of the skin of the patient and of the operator ;

(11) Catgut ;

(12) Drainage-tubes of various size ;

(13) Horse-hair for drains and stitches ;

(14) Carbolized silk for stitches ;

(15) Silver wire for stitches ;

(16) Lead buttons for " button stitches;"

(17) Loose gauze ;

(18) Gauze dressing ;

(19) Bandages, muslin, and gauze ;

(20) Elastic bandage ;

(21) Safety pins.

N. B.—No water must be used.

The patient having been placed on the table, mackintoshes are arranged so as to prevent soiling of the clothes, and around the part to be operated on, and over the clothes and mackintoshes in the vicinity, towels soaked in 1–20 carbolic lotion are fixed.   The object of these is that, should the surgeon lay down any instruments which he is using, he may lay them down on a pure basis, and may be sure that they will not take up any septic material from the place where they lie, while at the same time, should any of the clothes come in contact with the wound, it is protected from harm by having this pure layer interposed.   The skin of the patient and that of the operator having been purified in the manner already described, a spray of carbolic acid is made to play on the part from a suitable distance (about six feet).   If the spray be too near, it is unnecessarily wetting, while it is so narrow that the hand of the operator and his assistant will be constantly getting out of it. The spray is, on the other hand, perfectly efficient at a considerable distance ; it is not wetting ; and there is plenty of room for working in it.

A basin containing 1–40 carbolic lotion is placed between the wound and the operator, and in this he can repurify his hands or his instruments should they have been contaminated with septic dust, either from the clothes, or by holding them outside the spray.   All instruments, sponges, etc., must be handed into the spray, because every time that the operator has to reach his hand out of the spray, it comes in contact with septic dust, and must be repurified in the carbolic lotion before being introduced again into the wound. If the spray is to be used at all, these precautions are necessary.

There can be no doubt that the spray is the least essential of all the details

of the Listerian method. For, in ordinary air, there are comparatively few particles capable of causing fermentation. At the same time, there are particles, and, as we cannot know where such particles are, if we are to take the precaution of purifying the air, it must be done thoroughly, as if the air were full of these particles; and every time that the hands of the operator or his instruments have come in contact with unpurified air, that is, have been passed outside the spray, they must be repurified in carbolic lotion, before being reintroduced into the wound. The spray is a convenience, not a necessity. Aseptic treatment can be carried out without a spray; indeed for several years Mr. Lister did not use it. If, however, no spray is employed, we must not forget that septic particles are still present in the atmosphere, and must still be destroyed. This is done by washing out the wound every now and then during the course of the operation with carbolic lotion; and, after stitching up the wound, it is well to syringe it out immediately before applying the dressing. Of course all the other precautions must be observed. In some cases, as in empyema, the spray is almost a necessity, and in all it is more convenient and more certain than the method of washing out the wound. The steam spray acts automatically. Once put in action, it goes on of itself. By its use there is no necessity for applying the irritating carbolic solution to the wound. To wash out the wound with carbolic acid, is to irritate it very much, and in some cases to interfere with the chance of primary union; at the same time, it causes an increased amount of serous oozing, which, of course, tries the antiseptic dressing very much, washing out the antiseptic, and increasing the risk of putrefaction during the after-treatment. It is, however, well to bear in mind that, where no spray is at hand, the aseptic method may still be carried out, and that the spray is the least essential part of the method as at present employed. *The most essential part of the treatment is the thorough purification of everything (hands, instruments, etc.) which comes in contact with the wound. The introduction of an unpurified instrument into a wound is a much worse error, and one far more likely to be followed by bad results, than the momentary deflection or cessation of the spray.*

When, for any reason, it is necessary to stop the spray for a time during an operation, the wound may be protected in the interval by throwing over it a piece of muslin soaked in carbolic lotion, and termed " the guard." The guard is also used in the case of a large wound where the spray does not quite cover the whole of the wound. In this instance, the guard is thrown over the part of the wound on which the surgeon is not working, and the spray is directed over the rest of it.

The operation having been performed with the precautions detailed, the hemorrhage must be arrested. This is done by means of ligatures of *carbolized catgut.* There are two kinds of catgut which are at present employed: the *carbolized* catgut, which was that first introduced by Mr. Lister;[1] and the *chromic acid* gut, which lasts longer in the tissues than the former, and is more rapidly and easily prepared.[2] All bleeding points are tied, and the ligatures cut short. There is no excuse for leaving any bleeding vessel, as the ligatures cause no trouble afterwards.

The *drainage* of wounds treated in this way is a most important point. It may be accomplished by means of drainage tubes, or by capillarity. The *drainage tubes* employed are made of vulcanized India-rubber (Fig. 220), and are of various sizes. They are introduced to the deepest part of the wound, and are cut flush with the surface at the outer end, obliquely if the tube be oblique, and transversely if the tube runs directly inwards. To permit the

Lancet, April 3, 1869.   ² Lancet, February 5, 1881.

discharge to escape from all parts of the wound, circular holes are cut in the sides of the tube, at intervals, the diameter of each hole being about one-third of the circumference of the tube. To prevent the orifice of the tube from becoming displaced, loops of carbolized silk, knotted at the end, are passed through the outer part of the tube, and the knots, lying between the skin and the dressing, prevent the orifice of the tube from becoming displaced. Should there be a great tendency for the tube to slip in, the loops of silk may be filled with wet carbolic gauze. The orifices of the tubes are generally placed at the most dependent part of the wound, but this is not essential. For as long as there is a free opening for the exit of the discharge, it may simply be allowed to well out, because the discharge is unirritating, and, therefore, the quantity filling up the tube does no harm; at the same time, where possible, it is well to have a dependent opening. The chief point to be observed in determining the position of the orifice of the drainage tube, is to have it as far removed as possible from the edge of the dressing. Thus, in an operation for inguinal hernia, the orifice of the tube is not placed at the most dependent part, near the penis, because there would be very little space for overlapping of the dressing, but it is arranged at the uppermost angle of the wound, as far away as possible from sources of putrefaction. These drainage tubes are always kept ready for use, in a vessel containing 1–20 carbolic lotion. When a drainage tube is removed finally from a wound, it is washed in carbolic lotion, placed in the jar with the other tubes, and is then ready for use when required for another case.

It is well to leave a tube undisturbed for three days after an operation. If it be taken out sooner, there will often be difficulty in reintroducing it, but by the third day the tissues will have become condensed, and the tube will be lying in a comparatively firm channel, which will not collapse when the tube is removed. When it is taken out, it is washed in the solution, and, if it projected from the wound, a piece corresponding in length to the projecting portion is clipped off from the inner end, and the tube is then reintroduced. Frequently, on the third day, a smaller and shorter tube may be used. No definite rule can be given as to the best time for dispensing with the tube altogether. When the discharge is very little, and when the channel is comparatively straight, and not likely to become obstructed, the tube may be removed. This must, however, in the main be a matter of experience.

Drainage by *capillarity* was first tried by Mr. John Chiene, of Edinburgh. He combines with it the principle of using absorbable drains. The material which he employs is *catgut ;* several threads are brought out at a part of the wound, and the fluid flows out in the intervals between the threads. By using catgut he also avoids the necessity of removing the material employed for drainage, because the catgut becomes absorbed in a few days. Mr. Chiene stitches the centre of a skein of catgut to the deepest part of the wound by means of a catgut stitch, so that the drain cannot become displaced. He then breaks up the skein into bundles of six or eight threads each, and brings these out at various points along the line of incision. In a few days, the

Fig. 220.

Ordinary drainage tube.

portions of the threads projecting from the wound fall off, and the point of exit cicatrizes.   This method of drainage is very satisfactory in some cases, but the chief objection to it is that the catgut is apt to become absorbed too soon, before, indeed, a drain can be dispensed with.   How far the new chro-mic acid catgut will obviate this difficulty remains to be seen.   In some cases, *horsehair* has been employed instead of drainage tubes, and it answers very well where the discharge is purely serous.   It has, however, the same objection as drainage tubes, that it requires to be removed ; and there is a further objec-tion, that it is not as easy to reintroduce it as it is to reinsert a drainage tube.   In some instances, however, it affords the best means of drainage; for example, in situations where a tube might be liable to become compressed and obstructed, as in a joint.   Dr. Neuber[1] has quite recently applied Chiene's principle of absorbable drains to drainage tubes.   He *decalcifies bones*, drills a central hole in them, and cuts lateral holes just as in ordinary drainage tubes. These tubes, like Chiene's catgut drains, become absorbed in a few days, and answer very well in some cases.

The *stitching* of the wound is a matter of the greatest consequence with a view to rapid healing.   In wounds treated antiseptically, provided that the

Fig. 221.
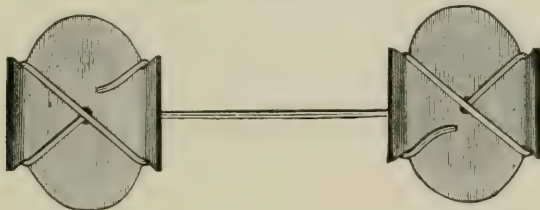
Button stitch.

drainage be properly arranged, the edges of the skin may be brought very accurately together, even where a large piece of skin has been removed, and

Fig. 222.
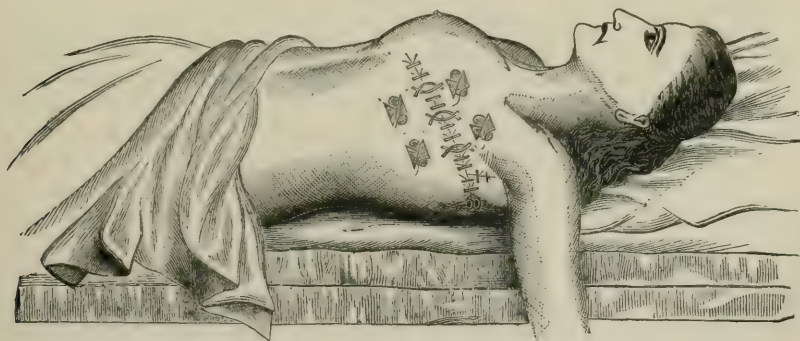
Shows the three kinds of stitches in a wound, and the arrangement of the drainage tube.

where, therefore, there is considerable tension.   To relieve the edges of the skin from this tension, and at the same time to allow them to be brought into accurate contact, *lead buttons* are employed in the following manner: A needle carrying a strong piece of wire, to the end of which a button is attached in

[1] Archiv für klinische Chirurgie, Band xxiv.

the way shown in Fig. 221, is introduced at some distance from the edge of the skin, carried through the wound, and brought out at a similar distance from the edge on the other side, where it is secured by a second button. Two or three pairs of these "*button stitches*" are inserted; these bear the strain, leaving the edges of the wound to be easily united by suitable stitches.   In some cases, there is still a little difficulty in bringing the parts together, in which contingency thick silver wire stitches are inserted at intervals, taking a deep and broad hold of the tissues, and being termed "*stitches of relaxation;*" and then the margins of the skin in the intervals between these are brought into exact apposition by stitches of carbolized silk, horsehair, or catgut. These latter stitches receive the name of "*stitches of coaptation.*"   (Fig. 222.) In this way union by first intention may be got in cases where, at first sight, it seemed impossible, even by the most violent traction, to get the edges of the skin into apposition.   The carbolized silk, which is used for stitches, is prepared by dipping ordinary ligature silk into a melted mixture consisting of nine parts of beeswax and one part of carbolic acid.   The ligature is wound on pieces of lead, and kept in stoppered bottles.

Having now completed the operation, the surgeon proceeds to apply the *dressing.*   A piece of protective, of suitable size, is laid over the wound, and this is overlapped in all directions by a mass of gauze wet in carbolic lotion. This arrangement goes by the name of the "deep dressing."   In wounds close to the pubis, or the mouth, or, indeed, in any situation where there is but little room for the overlapping of the gauze dressing, it is well not to use the protective, because it prevents the carbolic acid in the gauze from reaching the discharge beneath it, and, therefore, if the gauze only extends a little beyond it, the discharge may not receive enough of the antiseptic to prevent it from putrefying.   In any case, only as much protective as is necessary to protect the healing margin should be employed, and great care must be taken that it nowhere reaches to a point beyond the edge of the dressing, as the protective is only meant to protect the cut edges, and thus permit healing to occur; it is not used in cases of abscess, where there is only a drainage tube and no cut edge.   All hollows are filled up with loose gauze, and special masses of gauze are applied where most discharge is expected, and then the general gauze dressing is fastened on as before described.

The dressing is always changed on the day following the operation, and afterwards the rule is that, if, at the hour of the ordinary visit, discharge is found at the edge of the dressing, it is changed; if not, it is left till the next day, when the same rule is followed.   The dressing is never left longer than a week unchanged.   In changing the dressings, the spray is used.   After removing the elastic and common bandages—during the time required for which the patient or an assistant places his hand on the dressing, over the wound, to prevent it from being accidentally exposed—the spray is turned on, and the edge of the dressing next the spray is lifted, so that the spray passes in between the dressing and the skin.   There is no necessity for washing the wound.   A fresh piece of protective and wet gauze are at once applied, and then the skin all around is thoroughly washed with the lotion.   Loose gauze and a fresh dressing are then arranged.   The rules with regard to the drainage-tubes have been already indicated.   The stitches are removed when the line of incision has healed, or sooner, if any of them are causing irritation. In removing the stitches, those of *coaptation* are first taken away; then, a day or two later, the stitches of *relaxation;* and lastly, when the parts are soundly united, the *button-stitches.*   This, like the manipulation of the drainage-tubes, must be learned by experience.   Where dressings are to be left on for several days, it is well to rub a little salicylic acid around the wound.   This is most

conveniently done by using the acid mixed with carbolic glycerine, of the consistence of cream. This has the effect of preventing the troublesome eczema which sometimes occurs under dressings left on for some time.

If the surgeon does not have a spray at hand for the purpose of changing the dressings, its use may be rendered unnecessary by the employment of catgut drains and catgut stitches, and by fixing down the deep dressing so that the wound is not exposed when the outer dressing is removed. This deep dressing is treated like a wound, is washed with the lotion and covered with a piece of wet gauze overlapping it in all directions, and a fresh dressing is applied. If it be necessary to expose the wound, it is well, by means of a syringe, to let a current of carbolic lotion flow over it when it is exposed. In some cases, especially in country practice, it is desirable to leave the dressing unchanged for some days. This may be done in various ways, but perhaps the best is by the application of large masses of carbolic, salicylic, or iodoform jute, as recommended recently by Dr. Neuber.

Wounds near the *rectum* may be treated aseptically, but here the carbolic gauze is not applicable. For this purpose carbolic acid and oil, or carbolic acid and glycerine, 1–10, is employed. This is especially useful in cases of abscess near the anus. The abscess is opened under the spray, and, instead of a drainage-tube, a narrow strip of lint dipped in 1–5 carbolic oil is introduced. Then, outside this, is applied a mass of lint dipped in the glycerine and carbolic acid, which is fastened by a T-bandage. For some days the patient's bowels are kept at rest by opium, and afterwards, when he defecates, he holds the pad over the wound with his hand, defecates past it, washes the part with some 1–20 carbolic lotion, and pours fresh glycerine on the lint, or applies a new piece.

THE ASEPTIC METHOD APPLIED TO WOUNDS NOT MADE BY THE SURGEON.

These wounds are essentially of two classes: those which come under treatment at once, or within a few hours; and those which are not seen for some days after their infliction, till, in fact, fermentation has become firmly established.

I. WOUNDS WHICH COME UNDER OBSERVATION EARLY.—Here the problem is different from that which we have been considering. As yet we have merely had to exclude micro-organisms from wounds, but in these instances they have, in many cases, already entered, and we must extirpate them, and keep them out afterwards. To extirpate them, the wound is washed out with 1–20 carbolic lotion, or, in cases in which some hours have elapsed since the infliction of the injury, with 1–5 solution of carbolic acid in rectified spirit. Let us take, for example, a case of compound fracture. Here we have a complicated wound; air and dust may have been sucked into all its recesses, and have mixed with the blood-clot. The end of a gum-elastic catheter, connected with a syringe, is introduced into the wound, and the purifying solution is driven in through this. By means of the catheter, the carbolic lotion can be introduced into all the recesses of the wound. Care must be taken to leave the external wound freely open, so that the injected fluid may escape readily, for otherwise there would be a danger of the fluid penetrating among the layers of the cellular tissue, and causing inflammation, or even gangrene. It is well to squeeze out all the blood-clots. The drainage of the wound is next attended to, and, if necessary, the external opening is enlarged. The fragments are then brought into position, and the protective, wet gauze, and

gauze-dressing applied as usual. After a few days, the limb may be put up in plaster of Paris or other suitable material, a window being left for the daily application of fresh dressings. There are many other ways in which the limb may be fixed, space being provided for aseptic dressings; but these must be left to the ingenuity of the surgeon.

Some wounds may be stitched up, care being taken to provide for drainage, but, unless in the case of clean, incised wounds, it is better to leave the whole wound open, for otherwise there is apt to be inflammation, or even sloughing of the edges of the wound, and thus the state of matters is by no means improved.

Lacerated wounds behave beautifully under this treatment. The wound is thoroughly purified by scrubbing it well with carbolic acid, and then the salicylic cream, mentioned before, is applied in considerable quantity. Then a deep dressing is fixed on, and left undisturbed for some days. When the superficial dressing is changed, this deep dressing is treated like a wound, as described before. After a week or ten days, the deep dressing may be removed, and a fresh one applied. In this way a badly lacerated wound may heal without any suppuration or sloughing of the torn parts. Blood-clot fills up the wound, and remains there. In the deeper part of this clot, and in the deeper parts of the dead tissues, organization occurs by infiltration of young cells, and cicatrization takes place under the superficial layer of the clot, so that frequently, after a time, a superficial layer of blood-clot may be peeled off from above, and a cicatrix be found beneath.

Gunshot wounds may also be treated aseptically, and often with great success.[1] Reyher's experience in the recent Russo-Turkish war led him to the conclusion that the aseptic treatment of these wounds might be carried out in two ways, according to the state of the wound and the nature of the injury. If the wound was gaping, or if there was any reason to suspect that the bullet, in its course, had carried along with it portions of clothing or other extraneous material into the interior, it was necessary to wash out the wound with carbolic lotion after the manner described under compound fractures. When possible, the bullet was extracted. The skin around the wound was also purified with the 1–20 lotion, and a large antiseptic dressing of carbolic gauze or salicylic wool applied. This treatment was also necessary in all wounds caused by a ball or shell, which were of course lacerated wounds. In cases where there was no reason to suppose that the bullet had carried in any foreign matter along with it, and where the edges of the wound were lying in contact, this treatment was unnecessary, and it was sufficient to disinfect merely the orifice of the wound and the surrounding skin, and to apply a suitable antiseptic dressing. In carrying out this treatment, the spray is not necessary, but, if it is at hand, it is a great convenience, and renders the result more certain.

Burns may also be treated in some cases aseptically. Where the burnt surface is not extensive, an attempt should be made to purify it by washing it with 1–20 carbolic lotion. Then, if it be small, full strength boracic ointment of the following composition may be employed. (Make a basis of 2 parts of paraffine and 1 part of vaseline. Take of this 5 parts, and of boracic acid crystals 1 part. Mix.) Outside the ointment, which is spread on a piece of linen, several layers of boracic lint are applied. Where the burn is more

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[1] See Reyher on "Die antiseptische Wundbehandlung in der Kriegschirurgie." **Volkmann's** Sammlung klinischer Vorträge, Nos. 142 und 143, 1878.

extensive, and in cases in which, as a consequence, the use of carbolic acid would be dangerous, wet boracic lint dressing, that is, boracic lint used as water-dressing, is employed. Carbolic oil may be used in some cases, but, if the burnt surface is large, there is apt to be a fatal absorption of carbolic acid. Afterwards, the same dressing is used as in the case of ulcers, which will be presently alluded to.

II. WOUNDS IN WHICH FERMENTATION ALREADY EXISTS.—Wounds and sinuses which have not been treated aseptically, and in which fermentation therefore exists, often come under observation. Here an attempt may be made to destroy the causes of fermentation which already exist in these wounds, and these attempts are sometimes successful. In these cases, the micro-organisms not only exist in the discharges which flow from the wounds, but they are also present in the granulation-tissue lining them. It is therefore necessary not merely to disinfect these discharges, but also to destroy or disinfect the lining membrane of the wounds. For this purpose, the layer of granulations is scraped away by means of an instrument termed a " sharp spoon," introduced by Von Bruns for scraping away carious bone, and first used by Volkmann for the purpose under consideration. (Figs. 223, 224.) The whole procedure is

Fig. 223.

Fig. 224.

Volkmann's sharp spoons.

as follows : A spray being employed, the skin surrounding the sinus is thoroughly washed with 1–20 carbolic lotion, and then the layer of granulations lining the wound is scraped out with a sharp spoon. After this is done, the wound is thoroughly swabbed out with a watery solution of chloride of zinc (40 grs. to the ounce of water). It is well, where possible, to arrest the circulation by means of a tourniquet, so as to allow the chloride of zinc to act thoroughly. Then gauze, wet in carbolic lotion, and a carbolic gauze-dressing are applied as usual.

Where superficial ulcers have to be dealt with, it is not necessary to scrape the surface of the sore, and the spray is not employed. The surface of the sore is washed with the solution of chloride of zinc, or iodoform powder is freely sprinkled on it, and the surrounding skin is washed with 1–20 carbolic lotion. A piece of protective a little larger than the sore is then applied over it, and outside this, one or more layers of boracic lint, overlapping the protective well in all directions. The boracic lint is prepared by immersing ordinary lint in a saturated, boiling solution of boracic acid, and then hanging it up to dry. In the after-treatment, boracic lotion is employed instead of carbolic lotion. This is simply a cold, saturated solution of boracic acid in water. The lint and protective are removed, the sore is washed with the lotion, and a fresh dressing is applied. The spray is unnecessary. When the discharge diminishes, these dressings may be left unchanged for two or three days. As a rule, one application of the iodoform or chloride of zinc solution is sufficient, but if putridity still exists, they may be employed a

second time.   Sores treated in this way heal very rapidly if proper attention be also paid to position and rest; they heal more rapidly than by any other method of treatment.

Various modifications of the Listerian method have been proposed, but they have seldom been satisfactory, as they have generally failed to fulfil the requirements of the aseptic principle.   In the foregoing description, various modifications have been hinted at which may be followed out where better means are not at hand, and which will be efficient as long as they are used in strict accordance with the Listerian law.   Other antiseptics have been suggested instead of carbolic acid, but none of them have as yet been generally adopted.   Perhaps the best substitute is eucalyptus oil.   This has of late been used extensively by Mr. Lister in the form of eucalyptus gauze, and it acts very well.   It is of great value in those rare cases in which patients suffer from carbolic poisoning.   Eucalyptus gauze may be used in these instances without interfering with the aseptic principle.   I would be passing the space at my disposal were I to enter into the discussion of the various materials and modifications which have been proposed.   The foregoing description indicates sufficiently the best mode as yet known of applying the principle, and it will be evident that other antiseptics and antiseptic materials may be employed, and that the use of the spray may be avoided, where necessary, without in any way interfering with Listerism, which is a principle which must in the future always form the basis of any method of wound treatment.   When properly applied, it reduces all wounds to the level of subcutaneous injuries.

POISONED WOUNDS.

BY

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UNDER ordinary circumstances, if a healthy person sustains a wound of the skin, whether incised, lacerated, punctured, or gunshot, the tendency is toward repair of the local damage, without any other constitutional disturbance than may be due to the severity of the injury. By the older writers this was attributed to what they called the *vis medicatrix naturæ*, or healing power of nature, an expression which was objectionable, as implying an external force. It is more philosophical to say that healthy action is the law of being of living organisms, and of all their parts; and that they tend to return to this, if disturbed by any cause, as soon as that cause ceases to act.

But if, either at the time of infliction of the wound, or at some later date, before the healing has occurred, a poison is applied to the abnormally exposed tissues, there is superadded to the violence sustained, an irritation, which may not only change the local condition, but affect more or less profoundly the whole organism. The poisons which so act, and with which we are now concerned, are almost without exception of animal origin, and some of them would seem to be actually organized. Of their real nature, however, very little is known as yet, and the mode in which they produce their effects cannot be clearly explained. We can only describe the symptoms to which they give rise, and suggest theories as to the pathological conditions involved.

There are three ways in which poison applied to a wound (either at the time of its infliction or subsequently) may be supposed to affect the system at large: (1) Through the nervous system; (2) By absorption into the lymph current; (3) By absorption into the venous blood current. Very probably these are often combined in the same case; and it may be that in no single instance does even the slightest poisoned wound occur—such, for example, as a mosquito sting—without an irritation of the nerves of the part, and the taking up of an amount, infinitesimal as it may be, of the poison, not only by the lymphatics but also by the veins. Perhaps it should be stated that the evidence as regards venous absorption is less positive than that of absorption by the lymphatics, since the cases in which the former seems to have taken place are in many instances open to another explanation, viz., that the poison was conveyed into the venous system through the lymph-channels. Thus there are many cases in which the extension of inflammation along the lines of the lymphatics is quite clear; there are none in which equally distinct proof is afforded that the veins alone are so affected. But these points will be further referred to.

Certain conditions of system seem to favor the occurrence of poisoning in wounds. Such are depression, from fatigue or exposure; previous disease;

(83)

the effects of extremes of heat or cold, and perhaps of other states of the atmosphere, electrical or hygrometric. These influences are more clearly traceable in the graver cases, but are probably not without effect even in the more trifling. And we shall have to note, on the other hand, some singular instances of tolerance, or rather of insusceptibility, induced by habit. I shall take up in succession: dissection-wounds, and certain allied lesions; insect-stings; snake-bites; and bites of animals.[1]

DISSECTION-WOUNDS.

Under this head are included, not only wounds or poisonings contracted in the dissection of dead bodies, but an allied class of injuries sometimes sustained by surgeons in operating on the living, as well as under other circumstances, to be presently mentioned.

While in the very great majority of cases the poison finds an entrance through some crack, fissure, or puncture in the skin, there seems to be evidence that it may sometimes be absorbed through the sound tissues. Thus, Sir James Paget, in his most interesting account of his own case, says, " I had no wound or crack of any kind."[2] Wiart,[3] after describing a poisoning in his own person in 1862, from making an autopsy in a case of erysipelas, says, " I have always been convinced that I had not been wounded at all, that I had, neither on my fingers nor on my hand, any erosion to serve as a place of entry for the virus."[4] But even when there is no actual wound, if the cuticle is so cracked, as for instance, along the edge of the nail, as to give the poison access to the true skin, it may be taken up by the absorbents and produce mischief.

However the harmful material enters, there must be, as it seems from known facts, a certain condition of the system (perhaps various conditions) rendering it susceptible to injury. Those who are constantly dissecting may acquire, as Sir James Paget points out in the paper referred to, a marked degree of immunity, so that no bad consequences ensue upon the cuts and scratches which they are very apt to sustain. Yet this cannot be counted on, and those who are depressed by fatigue or other causes, as students often are after a winter's work, may be specially liable to this form of disorder. The period which elapses between the reception of the poison and the occurrence of trouble from it may vary greatly; sometimes inflammation is set up at once, or in the course of a few hours, while it occasionally seems as if there were a process of incubation, as in hydrophobia or in the eruptive diseases. Cases are upon record in which no symptoms have ensued for several days; but here there may have been some new influence affecting the system, without which the poison would have remained inactive.

In former times, before it was the practice to use antiseptic injections, such

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[1] It may be said here, that while it might be strictly proper to include tetanus, hydrophobia, and pyæmia in the present subject, there is in each of these diseases so new and formidable a chain of symptoms developed, in comparison with which the original wound ceases to have any importance, that they are generally accorded separate consideration.

[2] Clinical Lectures and Essays, p. 322.   [3] Gazette Médicale, July 23, 1881.

[4] In the American Journal of the Medical Sciences, for August, 1838, p. 396, there is an account of a typical case of diffuse cellular inflammation, ascribed by the reporter, Dr. J. M. B. Harden, of Georgia, to the violent motion of the arm during a long ride on horseback. The case was a fatal one, and at the autopsy Dr. H. contracted blood-poisoning through an existing wound in the finger. During his illness he was attended upon by his father-in-law, who dressed the abscesses, introduced tents, etc. This gentleman became ill after sudden and great exertion in putting out a fire, diffuse cellular inflammation manifesting itself, and terminating fatally. No wound is mentioned in his case, but only contact with pus. Another slighter case is said to have occurred in the person of another attendant upon Dr. H. during his sickness.

as chloride of zinc solution, in preparing bodies for the dissecting-room, dissection-wounds, or serious symptoms following upon them, were much more common than now. The danger is incurred in dealing with the tissues of the recently dead rather than with those in a state of advanced putrefaction, and it is well known that post-mortem examinations of those who have died of certain diseases—especially of puerperal fever, erysipelas, or pyæmia—are attended with peculiar hazard. It would seem as if the earliest changes undergone after the occurrence of death were those which developed the poison. Very possibly the *ptomaïnes*, or cadaveric alkaloids, substances allied to the vegetable alkaloids, recently studied by Brouardel and Boutmy, Selmi, and other European observers, may be found to play an important part in the causation of the mischief. With regard to these substances very little is as yet known, but it is stated[1] that they are supposed to be analogous to a constant ingredient of saliva, which, in a concentrated form, is the active constituent of the venom of snakes. M. Brouardel is quoted in the same connection as of opinion that the ptomaïnes may be formed during life. One point should be especially noted, viz., that the amount of poison absorbed in a case of dissection-wound (using this term in its general sense) makes no difference in the effect. The minutest portion seems to act as a ferment, and to change the condition of the whole mass of circulating blood. In this respect, the analogy between the dissection-poison and snake-venom seems to fail, since the effect of the latter is clearly proportionate to the amount and concentration of the dose received into the system, as in the case of mineral or vegetable substances taken by the stomach or rectum.

Symptoms of Dissection-Wounds.—In the slightest form, the effects of this species of poison seem to be purely local. Thus if the dissector has a prick or scratch on his hand, it may become the seat of slight inflammation, and in a day or two discharge a small quantity (perhaps only a drop or two) of pus. But the cuticle around generally dies and peels off, just as in the case of a boil, and the redness and swelling disappear somewhat slowly.

Sometimes, especially after the fingers have been for some time in contact with purulent liquids, and more particularly in abdominal abscesses, the poison may affect a chain of points on the backs of the hands. Thus in 1862, after making a post-mortem examination in a case of peritoneal inflammation, with suppuration, from an intestinal concretion in the vermiform appendix, I had four or five small abscesses on the back of each hand. In these cases, there seems to be no further action of the poison, although the local conditions are analogous to those present when inflammation extends upward along the course of the lymphatics. Occasionally there occurs enlargement of the lymphatic glands in the axilla, either without any notable lesion of the hand, or, if such should exist, without any traceable affection of the vessels. This, I think, is not apt to be from the ordinary dissection-poison, but may be met with where injected bodies are used for purposes of study; it seems to be from the irritant effect of the chloride of zinc or other chemical antiseptic employed. The swelling of the glands is chronic in its character, not painful, nor very tender, and has not in my experience run into suppuration, but has gradually subsided, under the local use of tincture of iodine. Agnew describes[2] a peculiar form of irritable sloughing ulcer of the hand, attended with marked constitutional disturbance, as a result of dissection-wounds. This I have never seen, although it has sometimes happened to me to note the very slow healing of severe cuts received in making autopsies; one in my own person,

[1] Gaz. Méd. de Paris, July 30, 1881.
[2] Principles and Practice of Surgery, vol. i. p. 210.

in 1860, remained open for seven months.   Bryant,[1] under the name of *Ver-ruca necrogenica*, proposed by Dr. Wilks, mentions a warty condition occasionally seen on the posterior aspect of the fingers, or on the knuckles, in those engaged in dissecting fresh bodies.   This lesion, called also "anatomical tubercle," seems to consist of an inflammatory hypertrophy of the cuticle, and to some extent of the true derm.   It is slow and obstinate in its course, unattended with any constitutional symptoms, and yields to local treatment by iodine and caustics.

In a severer grade of dissection-wounds, there is, in addition to the local irritation, a line of redness (sometimes several), extending up the forearm, and marking the course of one or more inflamed lymphatics.   There may also be more or less general swelling of the member, with tenderness and stiffness, and some degree of fever.   A not infrequent termination of a case of this kind is by swelling of a lymphatic gland, either on the front of the forearm, just above the elbow, or in the axilla.   When suppuration of the gland takes place, the poison seems to be discharged, and all the symptoms subside; but I have seen such a gland remain swollen and tender for some time after its healing had seemed complete.   The condition just referred to is very similar to what may be observed in many cases of injury to the foot, even in the apparently robust.   It not very unfrequently happens after the fracture of a toe, or even a slighter hurt, in laboring men, that a "bubo" is formed in the upper part of the thigh ; and the same may occur in healthy and well-nourished children, even in the better classes.

Still another class of cases may be mentioned, in which the local trouble consists in the development of a carbuncular swelling somewhere on the hand or forearm, or in a crop of boils in the same region ; in the latter case there is apt to be one large one surrounded by a number of small ones.   The constitutional symptoms, with fever and depression, may be quite marked during the height of the local irritation.

Sometimes the local disturbance is more violent, and a cellulitis of the finger ensues, with suppuration, tending to follow up the sheaths of the tendons ; this may occur without involvement of more central parts, but the constitutional symptoms are apt to be marked.   In the majority of instances, the whole limb is more or less concerned, and the cases would then come under the class next to be described.   With any of these forms of dissection-wound, except the anatomical tubercle, there is very apt to be a more or less extensive area of erythematous redness in the neighborhood of the lesion.

n the severest grade of these cases, the constitutional symptoms are very decided, and the local inflammation runs very high, extending rapidly toward the more central parts of the body.   At a variable period after the poison has been received, there is pain, itching, and burning at the spot, and a general sense of malaise and depression.   This is soon succeeded by headache, nausea, chilliness, and aching in the back and limbs.   The pain runs up the arm, and the whole member becomes swollen and tender, especially along the anterior and inner aspects.   Intense fever comes on, especially at night, and the patient is either sleepless, or disturbed by frightful or harassing dreams.   On the occurrence of suppuration, which may involve a large extent of the areolar tissue of the arm or side,[2] there are general rigors, and a further increase of fever.   Low muttering delirium is early developed, with great

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[1] Manual for the Practice of Surgery, 3d Am. ed., p. 66.

[2] At a recent meeting of the Clinical Society of London (Lancet, Feb. 19, 1881), Messrs. Heath and Cripps reported cases of gangrene of the arm from poisoned wounds.   In Mr. Heath's case amputation was successfully performed ; but in the other it was postponed until too late, and the patient died.   Sloughing of the cellular tissue, as already said, is very generally resent in these cases ; but gangrene of the limb is very rare.

prostration of strength, and profuse and fetid sweating. The tongue, at first coated with a dirty fur, becomes dry and brown, and the teeth are covered with sordes. During the accessions of fever, the temperature runs very high, and the pulse is extremely rapid. Sometimes the patient seems to succumb to the general systemic poisoning before there is time for definite lesions of internal organs to occur; but if the progress is less hurried, there may be a supervention of pleurisy or pneumonia of a low type, readily running into suppuration. Death may result either from prostration by the poison; or from deterioration in the quality of the blood, affecting the brain-functions; or from intercurrent inflammation of the lungs or pleuræ, or perhaps of the heart; or from secondary exhaustion. When recovery takes place, it is very slow, and resembles that from typhoid or other low fevers, being apt to be retarded by abscesses and other local disorders. Moreover, there is often stiffening and contraction of the finger which was the seat of the primary inflammation. For a time there may be also, when sloughing has been extensive, some impairment of motion in the parts concerned; but this is gradually done away with by time and the stretching incident to exercise.

From this brief sketch, it may be seen that the graver cases of this sort can scarcely be excelled in severity by those of any other known disease. And the analogy which they present to cases of phlegmonous erysipelas, as well as of pyæmia and septicæmia, is obvious. At the present day, the recognition of the fact that the condition is one requiring, not depletion, but the most active and energetic supporting measures, has led to a more judicious treatment, and it is only in extremely rare cases that the symptoms are not arrested before they assume the threatening character above described. But still, whether from previously-existing disease, as, for example, of the kidneys, or from fatigue or exposure, at the time or subsequently, the onset of the disorder is occasionally very violent, and the most prompt, energetic, and skilful interference may be of little avail.

For obvious reasons, the post-mortem investigation of disease of this kind is both difficult and dangerous; and we have but little knowledge of its pathology. The tissues of the limb affected are apt to be disorganized by diffuse suppuration, veins and lymphatics being alike involved, while the internal organs present inflammations of varying extent and intensity; but the sequence of the morbid conditions, even in the light of the most careful observation during life, cannot be unravelled. That the lymphatic system plays an important part seems unquestionable.

Allusion has already been made to the occurrence of poisoning of this kind from other causes than dissections. Thus surgeons sometimes sustain injury by scratching or pricking their fingers in the performance of operations, and symptoms analogous to those already described may ensue. Perhaps the most frequent source of injury of this kind is contact with rough points or edges of dead bone, as well as with pus, especially of an unhealthy or foul character. Carelessness in cleaning and handling instruments may also give rise to poisoned wounds. But in all these cases, the matters which act as poisons are practically dead.

I saw, in 1865, a child aged 22 months, who had been vaccinated by a woman living in the neighborhood, and who had diffuse suppuration, with sloughing of the areolar tissue, from beneath the scapula to the crista ilii. Death ensued in a day or two, and an autopsy was made; but the disorganization was so great that the exact sequence of lesions could not be determined. I believe, however, that this case was one of blood-poisoning by the use of a dirty lancet.

Another case of blood-poisoning by vaccination came under my notice in 1869, in which the disease assumed the form of erythema fugax. The vaccination had been per-

formed by a most careful physician, of high standing, and the child's parents were people of the best class; so that it was difficult to account for the origin of the poison, which proved fatal.

It will be sufficient merely to mention here the liability of surgeons to syphilitic infection, from absorption of the discharge from sores of that character, in the course of their professional duties. Fortunately this is rare.

It has been stated on a previous page that poisoning is more apt to occur from bodies recently dead (that is, in which the post-mortem changes are in their early stage), than in those which are already putrid. Yet animal substances in the latter state may be productive of injury in the same way. Thus Heath[1] speaks of the digital cellulitis known as whitlow, as sometimes caused in cooks and others by the handling of game which is "high." And a notice recently appeared[2] of the poisoning of the Medical Officer for Health for Rotherhithe, near London, by a wound of the hand received in making a microscopic examination of some pork. It is said that "the meat was so putrid that he was compelled to use disinfectants, which obscured the minute structures; but he satisfied himself that the animals had been the subjects of, if they had not died of, pig-typhus; and he believes also that they were trichinised." The report goes on to say that he had "narrowly escaped permanent maiming."

TREATMENT OF DISSECTION-WOUNDS.—The treatment of all these cases must be: to subdue the local inflammations, and to support the strength.

Wherever there is heat and swelling, with pain, either at the part injured or at points nearer the body, hot fomentations, hot poultices, hot lead-water and laudanum, and like dressings, will be found to give comfort. It should be mentioned that any wound received, or any puncture or cut becoming irritated, during a dissection or operation, ought to be at once washed clean, thoroughly sucked, and protected. I have myself great faith in thorough cauterization with nitrate of silver, or with a white-hot needle, if done at once. The best protective application afterwards is a strip of clean rag or lint thickly spread with any simple unguent, as cosmoline, carbolized cerate, or mutton-tallow. A clean cut may be closed with a strip of plaster, which should however be at once removed if pain or swelling come on.

As soon as suppuration occurs, the part should be freely laid open, and poultices applied. Should the inflammation extend up the arm, it has been recommended to place a cordon sanitaire around the member, by painting it with tincture of iodine or with a very strong solution of nitrate of silver. Either of these may be used, a band about an inch wide, encircling the limb, being applied above the higher limit of the area of inflammation. This sometimes seems to be of benefit in arresting the disorder, just as in erysipelas; but it cannot be relied on. Blistering has been used in the same way, and is recommended by Agnew.[3]

Tonics, such as iron, quinine, the mineral acids, and concentrated food, should be given from the very first, in as large doses as the stomach will bear. Carbonate of ammonium is a valuable adjunct in combating prostration. Stimulants are often imperatively called for, given either separately or along with the food. Dry champagne is well borne, and has the advantage of allaying the gastric irritability which is often a marked feature of these cases. When the fever runs very high, the ordinary febrifuges may be employed, and sponging with hot whiskey or bay rum and water. Anodynes

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[1] Medical Times and Gazette, June 18, 1881.   [2] Ibid., Aug. 31, 1881.
[3] Op. cit., vol. i. p. 212.

are sometimes demanded by the severity of the pain, and must be given. Opiates need not be withheld unless there is a strong tendency to cerebral congestion; they may be combined with the quinine, and the iron given separately. The bromides and chloral-hydrate, in mild cases, answer a good purpose; but the stomach may not always bear them well.

By way of *prophylaxis*, some dissectors are in the habit of smearing the hands, previous to beginning an autopsy, with cerate, either plain or carbolized; others use caoutchouc gloves or finger-stalls. But in neither case is the protection at all perfect. The cerates are soon removed by contact with the tissues, and the thin sheet of rubber is readily penetrated by a knife-point, a tenaculum, or a spicula of bone.

OTHER FORMS OF INJURY ANALOGOUS TO DISSECTION-WOUNDS.

There are certain other cases which may be most appropriately mentioned here, as they are closely analogous to those just spoken of.

FISH-WOUNDS.—Some *fishes* have sharp fins or spines, which inflict severe and "poisonous" wounds. An instance in point is reported by Murray:—[1]

A young man on the Irish coast was wounded by a fish called a "stang," a sort of herring, with hard scales and a sharp dorsal fin, well known to fishermen on account of the danger of its sting. The wound was in the ball of the thumb; the man sucked it, but he had pain up the arm as far as the axilla, and next day the whole limb was swollen, a bubo had formed in the armpit, and there was marked fever and headache. Pulse 98, temp. 100.5°. An incision was made, laying the wound open; poultices, and subsequently dry cotton, were used, and the arm was dusted over with dry bicarbonate of sodium. A purge was also given. The man made a rapid recovery.

In the Mediterranean, and in some Eastern seas, there are other fish which have dorsal spines capable of poisoning the wounds inflicted by them. Some again have the poison-spines connected with the gill-covers. One species is mentioned by Nielly,[2] as found at Panama, having four spines, two dorsal, and one attached to each gill-cover; each of these spines is said to be traversed by a canal leading to a sac full of liquid venom. The *Acanthurus*, met with in the waters about the Antilles, has its spines, which are mobile, on either side of the tail. The *skate*, or *ray*, is often called "sting-ray" or "stingaree," from its long, sharp, caudal spine, wounds from which are troublesome but not dangerous. Bathers along the Atlantic coast are often stung by the jelly-fish, or *Acalephœ*, found in the water especially after storms; the injury seems to be due to an irritating secretion ejected through the tentacles, and induces symptoms resembling those of urticaria, with occasionally a decidedly erythematous tendency.

OYSTER-SHELLS sometimes seem to have a poisonous effect, producing great irritation if the hands are scratched with them; in this respect they resemble the sequestra of dead bone, before mentioned.

ANIMAL TYPHUS.—I am tempted to refer here to a case reported by Pichon, and quoted by Dr. Jamieson, of Shanghai, China.[3] It was that of M. Charrier, a veterinary surgeon, who was examining a *cow suffering from typhus*, when the animal coughed up a quantity of foul discharge, part of which

[1] Lancet, Jan. 3, 1880.
[2] Éléments de Pathelogie Exotique. Paris, 1881.
[3] Medical Times and Gazette, July 23, 1881.

entered his mouth. He became very ill, with such local symptoms—diphtheritic stomatitis, with a strong gangrenous tendency—as seemed very like those of a poisoned wound. From the chronic septic poisoning which ensued, death resulted in about six months.

POISONOUS EFFLUVIA.—One other form of poisoning by animal secretions ought not to be passed over—that by *inhalation of effluvia.* The reader will find this fully discussed in a most interesting paper by Dr. William Hunt.[1] Except in the mode of its origin, and in the absence of primary local symptoms, it does not differ materially from the disorder already described.

Mr. H. E. Cauty[2] reports a case of poisoning of a sewing-woman from handling "*Imitation Moleskin.*" He says that, although there does not seem to be anything peculiar in the material, the women employed have to be very careful, as nasty sores are sure to be produced if they have any fissures or abrasions on the hands. This woman had on her hands nodules (seven on the right, five on the left) about the size of marbles, bright red, and very painful. These nodules suppurated in about a week; on the left hand there was some burrowing of pus, and on the 12th day some sloughing took place. Thirteen days after she was seen, two more nodules formed on the right hand; red lines extended up the forearm, there was glandular irritation at the elbow, and tenderness in the axilla. The skin exfoliated over the affected parts. Complete recovery ensued under the use of wine, cod-liver oil, and full diet.

WOOL-SORTER'S DISEASE.—Within the last year or two, attention has been called anew to a disorder known as "wool-sorter's disease," or "anthrax-fever." It seems to be analogous to the forms of toxæmia described in the foregoing pages, and perhaps to be a sort of connecting link between them and "malignant pustule." The following description of it is condensed from various articles in recent English journals, it having prevailed so extensively in and about the manufacturing town of Bradford, as to call for investigation and report.

The wool and hair of sheep and goats, imported for various purposes, was found to produce unequivocal attacks of anthrax, or "murrain," in sheep and cattle. Upon the persons employed in sorting and cleaning it, it produced effects classified as follows: (1) A purely local irritation at the seat of inoculation; (2) constitutional symptoms; (3) local manifestations followed by secondary localization of a constitutional infection; (4) a papule or pustule, not hitherto ascribed to specific infection, but not uncommon among wool-sorters, and those who make post-mortems in cases of anthrax. The stage of incubation is said to last from a few days to long periods. In the prodromal stage, there are chilliness, weariness and depression, sweats, flushing, and sleeplessness; a sense of constriction of the chest, sighing, yawning, aching in the limbs, cramps, headache, pain in the neck, dizziness, nausea, and vomiting. In the stage of full development, there are prostration, restlessness, quickened respiration and pulse, high temperature, *with irregular remissions,* pulmonary congestion, hæmoptysis, gastro-intestinal distress, diarrhœa, and jaundice in some cases. Twice tetanus was developed; once cerebral hemorrhage occurred. Recovery sometimes took place, without immunity from a second attack.

The pathological anatomy of the disease is thus described.[3] Early decom-

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[1] A Contribution to the History of Toxæmia. Pennsylvania Hospital Reports, 1868, p. 310.
[2] Lancet, July 23, 1881.   [3] J. Spear, Report to Local Government Board, etc.

position; petechiæ. *Heart* flabby, hemorrhages in its walls; endocardium blood-stained; often pericardial effusion; blood fluid. *Lungs* hyperæmic; small scattered hemorrhages in them; œdema, true pneumonia, or metastatic abscesses, or sometimes hemorrhagic infarcts. (The smaller hemorrhages were due to emboli formed of bacilli, the larger to acute nutrient disturbances of walls of bloodvessels or tissues.) *Bronchial glands* swollen, soft, or purple and blackish; *bronchial mucous membrane* reddened, with hemorrhagic extravasations; *pharynx* and *trachea* hyperæmic. *Abdominal organs* congested, with various hemorrhages. *Spleen* large and soft; *kidneys* congested, and the seat of cloudy swelling. Often acute *intestinal catarrh*, and swollen *mesenteric glands*. Sometimes albuminuric hemorrhages in the *brain*. Serous or serous and bloody, jelly-like infiltrations in the *connective tissues*, especially in the neck and mediastinum, in the sub-pleural and peri-renal tissue. Bacilli were usually detected in the blood and extra-vascular fluids. A curious fact was noticed—that this disease was apt to be developed by the eating of vegetable food, and thus to occur after the Sunday indulgence in this diet, usual with the wool-sorters.

INSECT-STINGS.

Very few insects can properly be said to bite, as they have not the apparatus for so doing; they insert a terebra or aculeus, and then suck, by means of a haustellum or sucker. In this act, they inject at the same time an irritating secretion of a peculiar kind for each species, but always acid. Most of them, in inflicting the injuries they do upon man, are simply obtaining nourishment, not attacking him; but there are some, as the bees and wasps, which are provided with poison-glands and stings as weapons of offence and defence. Of some varieties, as for example the mosquito, it is the female only that stings; the males do not leave their breeding places.

There are such differences between the effects of the stings of various insects, as would seem to indicate the possession of a specific character by each. Thus the *bedbug* causes a white wheal, surrounded by an area of redness, with intense burning itching, which, however, very soon disappears, and finally. When the bug is a very small young one, the wheals produced by it are correspondingly small, although they may itch intensely. Usually there are a number of punctures near together, marking the course of the insect as it crawls over the skin, each one being the centre of a separate wheal. For a few hours, the irritation may be re-developed by scratching. When in the eyelids, the swelling that ensues may be so great as to temporarily close them.

The *mosquito* induces a red swelling, somewhat conical, persistent, the irritation of which recurs occasionally, with or without apparent cause, for days. There is a different variety of mosquito, which comes with the first warm days of spring, and gives rise to a wheal like that from the bedbug, afterwards assuming the characters of the ordinary mosquito-bite.

Two cases of severe mosquito-bite are thought worthy of special record by Mr. G. Thin.[1] A medical man is said to have been "so cruelly bitten on the face and head, that he was much disfigured." In the case of a young lady, residing in the same hotel, "the bites were chiefly on the nose and upper parts of the cheek, and were seen as large, raised, flattened vesicles—not unlike a vaccine pustule, with a central depressed dark point, which corresponded to the point bitten. These vesicles had been confluent over the nose, and produced an appearance of impetiginous eczema, with well

[1] Lancet, Aug. 27, 1881.

defined borders. The discharge had, on some parts of the cheeks and chin, which had not been bitten, produced, secondarily, bullæ of what is often called impetigo contagiosa."

The sting of the *flea* produces a larger, very red and angry, flattened, long ovoidal swelling, or welt, with a peculiar velvety feel; it is very persistent.

The *louse* simply inserts its sucker into a follicle of the skin in search of nourishment, and the rupture of one or more small vessels is apt to occur. The ensuing inflammation is due more to the scratching than to the intensity of the poison.

Certain *midges* are sometimes met with in swarms at the seashore, and are very annoying by the sharp but very transient irritation caused by their suckers.

Among *flies*, the large "green-head," found on the Jersey coast in the late summer, and the "black fly" of June, in the northern woods, may, perhaps, be considered as the most troublesome species. The former produces a very severe irritation if allowed to penetrate the skin, as it often does in children.

Some of the *Ixodes* or *ticks* are very poisonous to man. There is a very small variety met with in dry, sandy woods in New Jersey, and perhaps elsewhere, which buries itself in the skin. I have known of two or three instances of children being nearly covered with them, especially in the legs and about the scrotum; the itching induced was intolerable, especially at night, totally preventing sleep. But in tropical climates, and occasionally in this latitude, the larger species are sometimes encountered. I saw a gentleman in 1881, who had had the horny head of a large Ixodes buried in the skin of his chest for several years, occasionally to his great annoyance.

Mr. R. R. Allen writes, from Natal, S. Africa, to the Lancet, Aug. 27, 1881, an account of the *Ixodes reticulatus*, or ox-tick, which buries its sucker in the skin, and when filled with blood, is half an inch long. He says : "On June 28th, I was bitten by one of these little animals in the right axilla. When caught, it was deeply buried in the flesh and 'full-blown.' I had to use force to extract it. The next, and four following days, I was very unwell, with severe frontal headache, which continued for three days, nervous depression, loss of appetite, thirst, pain, swelling, and stiffness of the muscles of my right arm and axilla. The axillary glands became hard, enlarged, and most painful, but did not suppurate. The punctures made by the tick became a pustule with a dark inflamed areola, which burst and dried up. The feverishness was considerable, and I suffered greatly from nausea, insomnia, and towards the end diarrhœa. I am now convalescent (July 4). Perhaps I got the tick from my horse, which was suffering from mange at the time."

The *scorpion* is very seldom met with, except in tropical countries, and there its sting, although very irritating, is seldom fatal. Swelling of the tongue is said by some writers to be a constant symptom in these cases, and sometimes a singular loss of power in the cervical muscles has been observed, as if the poison, when absorbed, acted in a special degree upon certain portions of the nerve-centres.

Spiders have a bad reputation, but the cases are certainly very rare in which dangerous injury is inflicted by any of the species known to us. Yet Stahl[1] reported a case in which the sting of a "black spider" on the elbow produced a condition of alarming collapse; and Hulse,[2] one in which like symptoms followed a hurt of the same kind on the penis. (In both these cases the old-fashioned antiphlogistic system, including copious venesection, calomel, and tartar emetic, with active purgation, was adopted. Hulse states that his patient took, within four hours, four ounces of laudanum and an equal quantity of aqua ammoniæ.)

[1] American Journal of the Medical Sciences, Aug. 1838.   [2] Ibid., May, 1839.

Centipedes (*Scolopendridæ*) can bite or nip with their mandibles, and some inflammation is apt to follow; a fatal case of this kind, in a child, has been reported by Dr. Linceicum, of Texas.[1] In this case the little irritated holes made in the skin by the *feet* of the insect were also noted, and any one who has happened to touch one of our common centipedes will be likely to have felt a peculiar slight thrill in the fingers, lasting for some time. But the amount of poison contained in these small animals is of course vastly less than in one such as Dr. L. describes—eight inches long and nearly an inch broad. Nielly[2] quotes from Moquin-Tandon an account of an officer at Cayenne, in 1828, who by accident swallowed a centipede in some water. Enormous swelling of the neck, profound nervous symptoms, and death, speedily ensued.

Attention may here be again called to the fact that in these poisonings by insects (and the same is true in the case of snake-bite, to be presently discussed) the quantity of venom taken into the system determines the severity of the symptoms induced. In this respect the disorder, for it seems to be one and the same, no matter what the source is, differs from that induced by dissection-wounds, in which the smallest dose of the morbific agent may develop the gravest possible constitutional condition. It is but rarely that any serious general disturbance follows upon insect-stings, although, when in large numbers, they may produce feverishness and languor. Travellers who are subjected to the attacks of bugs and fleas sometimes experience this, but the loss of sleep may have something to do with it. And cases are upon record in which death has resulted from bee-stings and other injuries of this kind.

In some of these instances men, and even horses or other animals, have been attacked by swarms of bees, wasps, or hornets, and have sustained so much injury as to destroy life almost at once. No very careful investigation of these cases has ever been made, and the circumstances have generally been such that even a skilled scientific observer would have found it difficult to note the phenomena accurately; but it would seem that so large a dose of insect-poison acted very much like snake-venom, and that the main cause of death was the shock to the nervous system. Of fatal results following single stings, Dr. James Mease[3] has recorded a number of instances, and refers to others. Dr. J. A. Lidell,[4] in an article on Injuries of the Scalp, refers to poisoned wounds of this region as especially dangerous, and gives accounts of and references to several cases of the kind now under consideration. Dr. A. L. Gihon, U. S. N., reports[5] a case of fatal poisoning occurring on board ship, at Nagasaki, Japan, by the sting of an unknown insect; the part attacked was a middle finger, and the symptoms resembled those of sedative narcotic poison. Four days elapsed in this instance between the onset of the disorder and its fatal termination; an unusually long period.

TREATMENT.—The treatment of all these cases is, in its general principles, the same; local irritation is to be soothed, and if constitutional symptoms occur, they are to be combated by appropriate remedies. Alkalies, as dilute aqua ammoniæ or solution of carbonate or bicarbonate of sodium, seem to neutralize the poison. Every boy knows the comfort given by a clay poultice to a bee- or wasp-sting. Ordinary poultices, or lead-water and laudanum, may be applied if there is much inflammation.

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[1] American Journal of the Medical Sciences, Oct. 1866.   [2] Op. cit.
[3] American Journal of the Medical Sciences, Nov. 1836, p. 265.
[4] Ibid., April, 1879, p. 336.   [5] Ibid., April, 1869.

SNAKE-BITES.

As is well known, there are many genera of snakes which are destitute of poison-apparatus, and wholly harmless to man. Life may indeed be destroyed by the boas or pythons, the constricting snakes, which enfold and crush animals, and occasionally human beings, before swallowing them as food. But it is with venomous snakes, strictly speaking, that we are now concerned. All kinds of reptiles are much more numerous in hot than in cold climates, and in hot weather they are more active, and the danger from those which are venomous is greater.

The principal poison-snake of North America is the rattlesnake, or *Crotalus horridus*; there is also the moccasin, the copperhead, or *Trigonocephalus*, the cotton-mouth (perhaps only a variety of the last-named), and a species of *Elaps*, of which the popular name is, I believe, the "harlequin." In India, the *Cobra*, the *Naia* or *Naja*, the *Daboia*, and the *Trimerisurus*, are, according to Fayrer,[1] those which are most frequently met with, and most hurtful to man. Among African snakes, the *Cerastes cornutus*, or horned snake, and the *Naja haje*, or asp, seem to be the best known. The *Jararaca*, a Crotaline species, is the chief pest of this kind found in Brazil and Central America. The only snake known in Europe is the viper. All these are land snakes, although they swim freely on occasion. Fayrer[2] describes and figures a large number of *Hydrophidæ* or sea snakes, which are very poisonous; they are found in the Indian and Pacific Oceans, and in the seas between Southern China and Australia. All fresh-water snakes are harmless, except perhaps the cotton-mouth.

It would be a waste of time to quote descriptions of these serpents, further than to say that the hooded snakes are peculiar to India, and the rattlesnake to America, one only among Indian snakes, the Halys Himalayana, belonging to the Crotaline or rattlesnake group; in it the rattle is represented by a caudal spine. The poison apparatus of snakes may, however, be briefly referred to.

POISON-APPARATUS.—All venomous snakes have at either side of the anterior part of the upper jaw, two long recurved fangs, movable[3] by means of a joint between the maxillary bone and the ecto-pterygoid. The poison is secreted in sacs lying behind and below the eyes; from each sac it is conveyed by a duct to a tube or canal in the corresponding fang, terminating at or near the tip of the latter. Thus the same action strikes the fang into the victim and injects the poison into the wound as it is made. Behind each fang lie others partly developed, ready to grow into its place should it be broken or extracted.

This apparatus, as well as the poison itself and its mode of action, has been, in the case of the rattlesnake, carefully studied and admirably described by Dr. S. W. Mitchell.[4] It appears to present itself with but slight modifications in all the venomous snakes. The fang is said by Holbrook to be, in the *Elaps* of our southern States, permanently erect, and not jointed as above described.

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[1] The Thanatophidia of India. London, 1872.   [2] Op cit.

[3] Fayrer (op. cit.) says that in the Hydrophidæ the fangs are small, and differ very little from the other maxillary teeth. They have also only a groove, and not a tube, for the transmission of their poison.

[4] Researches upon the Venom of the Rattlesnake: with an Investigation of the Anatomy and Physiology of the Organs concerned. Smithsonian Contributions to Knowledge, 1860. See also a paper by the same author, "On the Treatment of Rattlesnake Bites," etc. North American Medico-Chirurgical Review, March, 1861.

The *venom* is a glutinous, albuminoid liquid, varying in color, but generally yellowish or greenish, acid in reaction, without taste or smell. Neither heat nor cold, acids nor alkalies, long keeping, nor even decomposition, would seem to affect its activity as a poison. When taken into the stomach, it is wholly harmless, as indeed it is everywhere except in the circulating blood. It has been said to be hurtful to vegetable life; but this is disproved by experiments. This description of the rattlesnake poison, given by Mitchell, corresponds remarkably with Fayrer's account of the venom of the Cobra. No thorough chemical analysis of this substance has ever been made, although Dumas[1] is said to have found the composition of the Cobra venom to be analogous to that of yeast. At a recent meeting of the *Académie de Médecine*, in Paris, M. A. Gautier detailed some experiments upon poisons, and said that one curious result he had arrived at was " that poisons owed their deleterious action to the presence of a neutral and not albuminoid substance, and to that of another alkaloid substance, comparable to the cadaveric alkaloids—the ptomaïnes—concerning which there has been of late so much discussion, and which exist in variable proportions in the saliva of all animals; in birds, for example, this alkaloid is found in a state of dilution seven or eight thousand times more marked than in the poison of snakes."[2] These statements cannot be accepted without further inquiry, but they deserve consideration, and may lead to a more fruitful study of the subject.

MORTALITY FROM SNAKE-BITES.—Snake-bites are generally very much dreaded, and the popular opinion is that they are almost inevitably fatal. Fayrer says that, in India, the number of deaths per annum from this cause is "perfectly appalling." It would appear from the official returns,[3] that 10,064 persons were said to have thus lost their lives in Bengal, in 1880; but some doubt is thrown on this estimate by the statement that an immense proportion of these cases were really suicides, falsely reported as snake-bites by their friends, " to save the honor of their families." Mitchell, in the paper before referred to,[4] shows very clearly how it is that many rattlesnake-bites fail of fatal effect, and deduces from an analysis of cases, that recovery occurs in at least seven-eighths of the whole number. Perhaps the greater abundance and activity of the snakes in India, as well as the swarming population, their habits of life and dress, and their inferior powers of resistance, may account for the fatality of these injuries in that country. It is probable that the poison-apparatus is used by snakes against man in self-defence only, as when they are trodden upon or irritated, or startled by a sudden approach.

SYMPTOMS OF SNAKE-BITES.—As to the effects of the venom, it has been said, on a previous page, that the dose—the amount received into the system—has much to do with their severity. It is probable, also, that if the poison is discharged into the subcutaneous areolar tissue only, it may induce only local irritation;[5] while if it enters a vein, and thus goes directly into the circulation, the results are much more serious. The part bitten immediately swells and becomes intensely painful, both swelling and pain extending up toward the body. Along with this there is intense congestion, and ecchy-

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[1] Philadelphia Medical and Surgical Reporter, 1873, p. 216.
[2] Gazette Médicale de Paris, Juillet 30, 1881.
[3] British Medical Journal, Nov. 12, 1881.
[4] North American Medico-Chirurgical Review, March, 1861.
[5] As in many other forms of poisoning, the symptoms are sometimes anomalous; for instance, a case is reported (Lancet, July 9, 1881, p. 75) by an East Indian surgeon, whose name is not given, in which, two hours after the receipt of a snake-bite in the right foot, pain extended up to the groin; next day it reached the right axilla, and the left forearm and elbow were painful and greatly swollen. Under the use of hot fomentations the man was well in a few days.

motic spots appear. Very marked symptoms of shock are soon manifested; fainting, giddiness, vertigo, loss of speech,[1] dimness of sight, with clammy sweats and great terror; nausea, vomiting, intense weakness; rapid, feeble pulse and labored respiration. Death may occur in a very short time—less than half an hour in one case on record, forty minutes in another[2]—but oftener in the course of from five to forty-eight hours. When the struggle is prolonged beyond this period, the symptoms just spoken of give way to those of the more ordinary forms of septic poisoning or septicæmia, and death takes place by exhaustion or failure of nerve-power. In these cases, it would seem that the venom, unlike the other animal poisons before considered, gained access to the system through the veins, and not by way of the lymphatics, since the latter do not show any sign of special involvement; and the rapid onset of general symptoms would indicate that the whole mass of the blood was affected at once.

But, as has been before said, in many instances the threatening symptoms either do not come on at all, or subside in the course of a few hours, sometimes even without active treatment, at least of a scientific kind. Such is the case almost always in viper-bites; thus an account is given[3] of a gentleman, M. Dumeril, being bitten five times in the arms and hands by a very large viper; he fainted twice, and was very ill for twenty-four hours, but recovered perfectly. Dr. T. S. Savage relates[4] two cases of the bite of the Cerastes cornutus (or nasicornis), a snake very much dreaded by the natives of South Africa, neither of which was fatal. And, from inertness of the venom, the small amount injected, or the failure of one or both fangs to penetrate the skin, even the rattlesnake-bite is often sustained without causing death. Hence, as Mitchell[5] points out, remedies are often vaunted which really have but little to do with the patient's recovery.

In some instances, as in one of viper-bite reported from Cyprus,[6] the symptoms induced by snake-venom strongly resemble those of phlegmonous erysipelas from more ordinary causes.

Pathology and Morbid Anatomy.—As to the pathology of snake-poisoning, we have not many positive facts. One thing seems to be well established, viz., that the venom acts as a septic ferment upon the blood, breaking down its coagulating power, and disintegrating the red corpuscles. Whether the effect of the poison on the nerve-centres is direct, as Fayrer asserts,[7] or whether it is a secondary result of the vitiation of the blood circulating through them, does not seem to be clearly determined. The post-mortem appearances may be briefly stated to be:—in the neighborhood of the bite, extravasations of blood, and softening of all the tissues; in the internal organs (the brain, spinal cord, and kidneys especially), more or less intense congestion, with ecchymoses in the subperitoneal areolar tissue, and fluidity of the blood mass. Dr. Lacerda Filho is said[8] to have published, in a Brazilian medical periodical, the following conclusions, based upon experiment: "(1) The poison of the Crotalus horridus acts upon the blood by destroying the red blood-corpuscles, and by changing the physical and chemical quality of the plasma; (2) the poison contains some mobile bodies similar to the micrococcus of putrefaction; (3) the blood of an animal killed by a snake's bite, when inocu-

[1] W. Ogle, St. George's Hospital Reports, 1868.
[2] Shapleigh, American Journal of the Medical Sciences, April, 1869.
[3] American Journal of the Medical Sciences, July, 1852.   [4] Ibid., Jan. 1849.
[5] Op. cit.   [6] Heidenstam, Lancet, Feb. 19, 1881.
[7] Indian Annals of Medical Science, quoted in American Journal of the Medical Sciences, April, 1871.
[8] British Medical Journal, Nov. 12, 1881.

lated in another animal of the same size and species, causes the death of the latter within a few hours, under the same symptoms and with the same changes of the blood; (4) the poison can be dried and preserved for a long time without losing its specific quality; (5) alcohol is the best antidote as yet discovered for this poison." This writer further claims to have ascertained that the venom of the Hachesis rhambeata possesses the power of digesting albuminous substances, and emulsifying fats, and infers that the local effects of its inoculation may perhaps be regarded as in effect a digestion of the living tissues. He thinks that it may serve, not only as a means of attack or defence, but may aid in the digestion of the victim. M. Couty, commenting on these statements, points out that " the venom of snakes is not a simple poison, but a pathogenic agent, capable of selecting certain organs and tissues." On its intravenous injection, there always ensue hemorrhages in the lungs, in the endocardium of the left side of the heart and not in that of the right, in the meninges and not in the nerve tissues, less commonly in the stomach, intestines, and kidneys. Different animals show very different degrees of susceptibility; thus, the monkey is said to be about a thousand times as susceptible as the frog. " Many of these poisons, after keeping, contain various bacteria, which can be cultivated, and the culture-liquid, or the fluids from an inflammation due to the poison, cause symptoms different from those of the poison itself, and comparable to simple septicæmia. The venom is thus not an organized virus."

While the foregoing statements may be taken as true, or at least as embodying the general results of observation on snake-poisoning, it is by no means impossible that further study may show that differences exist between the venom of one species and that of another, or, it may even be, between different samples of venom. Fayrer thinks that the poison of the Naja does not destroy the coagulability of the blood, while that of the Daboia makes it perfectly and permanently fluid. Halford[1] described certain cells developed in the blood of animals, killed by snake-poison, which he thought might prove to be a means of diagnosis in doubtful cases; but Mitchell[2] asserts that these are not new organisms, but only leucocytes, confirming his view by microscopical observations made by Dr. J. G. Richardson. Hodgkinson[3] says that the bites of the Australian snakes have less local effect, and exert their influence more upon the general nervous system, than those of the snakes of other countries.

TREATMENT OF SNAKE-BITES.—With regard to the treatment of snake-poisoning, the remedies that have been proposed, and even those that have been declared to be infallible, can scarcely be counted, and it would be simply a waste of time to enumerate them. A few, however, which have been brought forward upon plausible grounds by scientific men, may be mentioned. Bibron's antidote enjoyed a wide reputation for some years; it consists of iodide of potassium, gr. iv; bromine, f℥v; corrosive chloride of mercury, gr. ij:—10 drops at a dose. Ammonia has been advocated by various authors for the last seventy years,[4] notably of late by Halford. Shortt is said[5] to regard potassa as a reliable antidote, neutralizing the venom. Iodine has been depended upon by others. Dr. Anderson, of Wilmington, North Carolina,[6] has recorded two cases of rattlesnake-bite successfully treated by means of bromide of po-

[1] British Medical Journal, Dec. 21, 1867.
[2] American Journal of the Medical Sciences, April, 1870.   [3] Ibid., April, 1845.
[4] First by Mangili, in 1813.
[5] Letter from Madras, in Medical Times and Gazette, Aug. 23, 1873
[6] American Journal of the Medical Sciences, April, 1872.

tassium, and recommends its further trial; he used stimulants also. But the
fact seems to be established by the intelligent observations and experiments
of Mitchell, Fayrer, and others, that there is no known antidote by which
the venom can be neutralized,[1] nor any prophylactic against it. Hence, medi-
cation with this view is to be avoided altogether, and the aim of treatment
should be to prevent the poison from gaining access to the general circulation,
and to obviate its prostrating effects if its entrance has already taken place.

As soon as practicable after the receipt of the wound, a broad ligature
should be tied, so tightly as to check the circulation, around the limb above
the upper limit of any swelling which may have appeared, and the wound
itself should be thoroughly sucked; the poison is harmless when taken into
the mouth. Another plan is to apply cupping-glasses over the wound; this
mode of treatment was, at one time, strongly advocated, and seemed to pro-
duce good results.[2] Mitchell,[3] however, doubts whether sucking can remove
any of the poison through the narrow fang-track, and thinks that cupping only
delays the poison for the time in the neighborhood of the part bitten. Some-
times the site of the wound is not such as to admit of either of these measures;
thus in one fatal case it was on the bridge of the nose. Very prompt cauterization,
either with a hot iron or coal, or with the potential cautery—bromine or iodine,
solid or in strong tincture—may coagulate the tissues, so as at least in some
measure to hinder absorption; the hot iron will actually destroy the venom.
Instant excision has seemed, in some cases, to prevent ill effects,[4] or, in the
case of a finger, amputation may be resorted to, as more likely to remove the
entire dose of the poison. A plan which has apparently much in its favor, is
to slacken the ligature somewhat at intervals, say for five minutes at a time, so
as to allow the poison to be admitted little by little, and thus to be dissipated.
By slightly shifting the constricting band, so as to change the part of the
limb pressed upon, some advantage will be gained. It must be remembered
that the continuous application of a tight ligature for twenty-four hours, or
even less, would greatly endanger the life of the constricted limb, and, al-
though this would be a less evil than the death of the patient, it is one to be
avoided if possible. Fomentations or poultices (a poultice of tobacco-leaves
is a favorite Southern and Western remedy) are the best local applications.
With these it will, of course, be proper to combine anodynes.

The *constitutional treatment* in these cases is of the utmost importance, but
is founded upon the very simple principle of sustaining the strength until the
poison shall have been eliminated. To this end, stimulants are given as freely
as the patient can bear them. Ammonia is valuable in this way, especially,
perhaps, in the earliest stages, where its diffusibility renders its action very
speedy. Along with it, and at a later period, whiskey seems to be the most
reliable of our resources. Very large quantities have been taken under these
circumstances without intoxication being induced. The object is not at all
to bring about this condition, which would even favor the injurious effect of
the poison, but simply to keep the vascular and nervous system stimulated
to the activity required to effect elimination. Should life be maintained,
the patient does not for some time feel the need of food; but the addition of

[1] The latest claim of this kind is made in a letter to the Medical Times and Gazette, Aug. 27,
1881. The writer says that Dr. Lacerda Filho asserts that the permanganate of potassium is in-
fallible; neither the dose nor the mode of administration is mentioned. Mr. Vincent Richards
(quoted in the *British Medical Journal*, Dec. 31, 1881, from the *Indian Medical Gazette*), is said to
have found this remedy effectual in neutralizing the cobra-poison. These statements certainly
need confirmation.
[2] See Pennock, American Journal of the Medical Sciences, May, 1828; and Rodrigue, ibid., Aug.
1828.
[3] Op. cit.   [4] Agnew, op. cit., vol. i. p. 229.

an egg to the whiskey (the two being beaten up together) every two, three, or four hours, would probably prove judicious.

The after-treatment of cases of this kind will suggest itself: a condition of debility often ensues, requiring the free use of the ordinary tonics, quinine, iron, strychnia, and, perhaps, the mineral acids. But, as has been already said, there is sometimes a remarkably rapid return to health upon the elimination of the poison, in which case no after-treatment will be required.

BITES OF OTHER ANIMALS.

The peculiar symptoms often induced by the bites of *rabid* dogs, cats, and other animals of allied tribes, constituting the disease known as hydrophobia, have been made the subject of a special article (vol. i. p. 215). In most cases of this kind, opportunity is afforded to determine, either by previous knowledge or by subsequent observation, whether the animal which inflicted the bite had or had not been hydrophobic. But symptoms, either of this or of other forms of poisoning, to be presently mentioned, occasionally arise from bites inflicted by wild animals, or animals of which nothing is known. Thus a case is reported by Acting-Assistant Surgeon Wolfe, U. S. A.,[1] of a boy, aged 12, who was attacked with a fatal disease, resembling in all respects hydrophobia as ordinarily met with, three weeks after receiving two bites from a *skunk*. Other such cases have been placed on record, and the name " rabies mephitica" has been given to the malady. Now it can scarcely be supposed that hydrophobia could prevail among wild beasts, especially as travellers inform us that the disease is wholly unknown among the half-savage dogs which swarm about Constantinople and other eastern cities. Were it otherwise, the propagation of the poison would be so rapid, in the constant fighting of these animals, as to exterminate them in no long time. Hence we must infer, if the facts are known and justly interpreted, either that sporadic cases of hydrophobia do occur among animals, either domesticated or wild, or that the disease may be developed in man by the bite of an animal which is itself healthy.

The bites of *cats*, although sometimes very severe, do not seem to have any special effect in the way of causing blood-poisoning. I have seen one case in which a sick cat bit a servant-girl on the thumb, tearing the tissues deeply for over an inch ; the wound was cauterized, and healed kindly, and the patient continued well, to my knowledge, for several years.

Injuries inflicted by the larger felines, as by *lions, tigers*, etc., are sometimes met with among the employés of menageries ; several such instances have occurred in this city within the last twenty years. A good deal of shock seems to attend these cases, and in one of lion-bite, reported by Dr. John Ashhurst, Jr.,[2] the rapid occurrence of traumatic or spreading gangrene was a noticeable feature, the patient dying in forty-eight hours. No evidence, however, exists to show that there is any actual blood-poisoning, any more than in injuries of like gravity sustained in railroad or other accidents. The same may be said of the shark-bites occasionally observed along the seashore, or in bathers in large rivers near the ocean. Such cases are not uncommon in India, and several have occurred in New York within a year or two.

One case of apparent blood-poisoning from the bite of a *rat* has come under my own observation,[3] and seems of sufficient interest to be detailed here :—

[1] American Journal of the Medical Sciences, Oct. 1875, p. 567.
[2] See vol. i. p. 561.
[3] It was published in the Philadelphia Medical Times, August 1, 1872.

W. T., aged 7, a very stout and healthy boy, was bitten severely in the left forefinger, between the knuckle and the first joint, by a rat which he had caught. Fearing punishment for playing in the street, he concealed the real nature of the injury for two weeks, when I was called to see him. The soft parts about the phalanx were now (June 11) enormously swollen, purplish red, and shining, the hand was somewhat puffy, and a gland as large as a chestnut was felt in the anterior fold of the axilla. The boy had some fever, especially at night, and was listless, and without appetite. Next day I made a free incision into his swollen finger, but very little pus escaped. He was put on the use of the muriated tincture of iron, with a febrifuge at night, and poultices were applied locally. The symptoms all subsided; but on June 18, I was again called to see the patient, as he had a chain of small glandular enlargements all the way up the forearm and arm, while the swollen gland in the axilla had increased to the size of a walnut. By the third day, under hot sponging, all the lumps had gone; but on June 27, he presented a most curious phenomenon; patches, as if the skin had been bruised, very slightly raised, of a pale-purplish, brown, mottled color, extended up the radial side of the forearm, and around the front of the arm to the axilla, up in front of the shoulder, and on the side of the neck to the head. One separate patch existed on the middle of the forearm, and another near the anterior axillary fold. A large patch occupied the axilla. Many similar but less vivid patches existed on the body, and even down on the legs. Each patch had a red rim, clearly marking the line between it and the healthy skin. The only tender patch was that on the left side of the neck; but the boy complained somewhat of soreness, apparently muscular, all over his body. There was no stiffening of the jaws, nor other sign of tetanus. For several nights there was high fever. Under the steady use of the iron, with hot sponging, all these symptoms abated, and on July 2, I ceased attendance. On July 15, I saw the patient again, and found that he occasionally had a re-appearance of the patches, but very faint, and with no constitutional symptoms.

The phenomena here, as in most cases of poisoning by the bites of animals (excepting always the specific ones before referred to), seem to have been those of lymphangeitis, with, in this instance, a very mild attack of septicæmia supervening. But they may assume a far graver type; thus Kocher reports a case of acute sepsis, with embolic pyæmia proving fatal in forty-eight hours, which followed the application of a leech to the gum.[1]

With regard to the *treatment* of all these cases, it can only be said that it must be based on general principles. Local inflammation is to be combated, and the strength of the patient maintained; the special means of effecting these objects have been elsewhere detailed, and need not be repeated here.

[1] British Medical Journal, Oct. 16, 1880, p. 633.

SABRE AND BAYONET WOUNDS; ARROW WOUNDS.

BY

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SABRE AND BAYONET WOUNDS.

WHILST the injuries inflicted by the *sabre* may be classed among incised wounds, yet they differ among themselves in point of cleanness of cut, according to the sharpness of the weapon and the way in which it is handled. As ordinarily used in war, the sabre has a dull edge, like the back of a table knife; rarely are the sabres ground. Such a weapon, then, makes a wound by the weight of the blow, not by the velocity of the cut, and the wound which it makes must be more or less contused. Nevertheless, these wounds heal as readily as incised wounds made with keen-edged weapons, although they are more apt than the latter to be followed by noticeable scars. Sabre-wounds, and with these I include all sword-wounds, for thrusts with the sword are very rare, are of infrequent occurrence in modern warfare, owing to reduction in the cavalry arm, and to the changes which of late have befallen its functions.

The *bayonet* makes a punctured wound, and, this weapon being more or less blunt, its wound is apt to be a good deal contused. The weapon is triangular in section, and makes a wound with three radiating branches. The spade or trowel bayonet, if it ever wounds at all, will make a wound like any other spade. Like all other punctured wounds in cellular and muscular tissues, the gravity of a bayonet wound depends upon its depth; at the moment of making the wound, the several tissues through which the weapon passes are in different states of tension, and, as soon as the weapon is withdrawn, the several tissues resume their natural state, and thus cause an interruption in the continuity of the wound, or, in mining phrase, produce "faults" in it. If the parts heal by first intention, as they usually do, no harm is done by these "faults," but if pus forms, it will not be able to find its way to the surface by the wound, and hence burrowing and abscesses. These wounds, like sabre-wounds, are of very infrequent occurrence. The soldier as a rule dislikes to use his bayonet. I was told by an officer engaged in the Mexican war, in 1846, that, at the capture of the city of Mexico, he saw soldiers firing their muskets into the bodies of certain of the enemy, to whom quarter had been refused, with the bayonets actually resting against the persons of the slain. Both sabre and bayonet wounds are quite as often received in private quarrels and disturbances as in battle.

STATISTICS OF SABRE AND BAYONET WOUNDS.—In the British army in the Crimea, about 11,900 wounded men were received into hospital. There were only 76 cases of bayonet wound, with 7 deaths, and 87 of sword wound, with

(101)

one death.   In the same war there were 2700 killed in action, and, if the same proportion should hold for these, the total number of cases of bayonet wound would be 93, with 24 deaths, and of cases of sword wound 107, with 21 deaths.   The records of the Mexican war of 1846 make no distinction between gunshot and sword and bayonet wounds, nor can I find any statistics of the relative frequency of these two classes of wounds in the Franco-German war of 1870.   In the late War of the Rebellion, out of a total of 400,000 wounds, there were 22,700 incised and 5900 punctured wounds.   But few of these, however, were inflicted with sabre or bayonet.   If a man cut his finger while "whittling," and was taken on sick report, he constituted one of the 22,000 subjects of incised wounds.   The punctured wounds were usually of the same trivial character.   No data exist from which a correct and exact statement can be made of the relative frequency of gunshot wounds and sabre or bayonet wounds during this war.   In the Medical and Surgical History of the War of the Rebellion, 481 cases of sabre wound, with 18 deaths, and 188 cases of bayonet wound, with 19 deaths, are noticed, and are explicitly attributed to the weapons named.   How many more of the 400,000 wounds were bayonet or sabre wounds cannot now be determined.   The fact that these wounds are of very infrequent occurrence, is so well known to military men that it has been proposed by more than one officer to discard both weapons; and, indeed, one of the strongest arguments for the substitution of the trowel-bayonet for the weapon of the old pattern was the fact that the offensive powers of the latter were of so little importance.

SABRE WOUNDS OF THE HEAD.—Of the 282 cases of sabre wound of the *scalp*, recorded in the Medical and Surgical History of the War, 263 ended in complete recovery, while 11 patients were disabled, 3 died from intercurrent disease, and 3 died of the injury.   There were 49 cases of wound of the *cranium*, of which 13 terminated fatally, mostly from encephalitis.

In some cases the sabre will completely detach a circular plate of bone, and leave it hanging by the scalp.   The proper treatment of such a case is not settled.   The temptation, of course, would be to put bone, scalp, and all, back into place, and let them unite, if they would.   But it seems to me that the probabilities of non-union, and the risks of necrosis, suppuration, and encephalitis, would greatly outweigh the advantages of having a bony cover for the wound.   My own practice would be therefore that recommended by the Historian of the War of the Rebellion, to dissect out the bone, saving the pericranium if possible, and then to hold the soft parts in their place by a sufficiency of antiseptic catgut stitches.   In cases of sabre wound of Steno's duct, the experience of our war was that spontaneous healing might be counted on.   I myself saw such an event happen, during the war, in a case of gunshot wound of the duct in question, [and an equally fortunate result was obtained, a few years since, in a case of *salivary fistula* resulting from gunshot wound involving this duct, under the care of the Editor.]

SABRE WOUNDS OF THE ABDOMEN.—Sabre wounds of the abdomen are rare, for the dull sabre is incapable of cutting the soft, yielding, abdominal tissues, protected as these are by folds of cloth, and sword stabs are not very common.   Our soldiers, contrary to the theoretical teachings which they receive, use the edge of the sword rather than its point.

SABRE WOUNDS OF FOREARM.—Formerly, when duels with swords were more common than at present, the object being to disable rather than to kill an antagonist, wounds of the flexor muscles and tendons of the sword fore-

arm were frequent. These were inflicted by a draw cut of the back of the sabre, which was kept as sharp as a razor for this purpose. Such a wound should be treated, after the arteries are secured, by placing the limb on a splint so arranged as to flex both the fingers and the hand, and by adopting a strictly antiseptic dressing.

BAYONET WOUNDS.—Bayonet wounds penetrating the skull were in our late war generally fatal—four deaths having occurred in five cases. The penetrating bayonet wounds of the chest seem to have been equally fatal, whilst of eleven patients who received bayonet wounds of the abdomen—in some of the cases the bowel was transfixed—eight recovered. The cardinal point in the *treatment* of bayonet wounds is to secure rest. If a limb is hurt, it should be put on a splint, and a bandage applied to keep the muscles quiet, and the patient should be required to keep the horizontal position. If the lung is wounded, opium should be given to secure rest, and Guthrie's rule, to lie upon the wounded side, might be enjoined. If the abdomen has been penetrated, opium must be given in very large doses, or rather very decided effects must be produced by the opium, and the patient's diet must be most strictly guarded. The patient must of course be kept in bed until all risk of peritonitis has passed by.

ARROW WOUNDS.

HISTORY OF ARROW WOUNDS.—The arrow is a weapon of the greatest antiquity. Not only can we infer its possession by primitive man, from its use at the present day by the most savage tribes, but the earliest writings and the oldest sculptures, and the treasures of the caves, all testify that from its infancy the human race has drawn the bow. Accordingly we find that the arrow was of particular interest to the surgeons of antiquity, who discussed at length the wounds which it caused, giving specific rules for the treatment of the wounded, and inventing instruments for the removal of the missile. Homer, in the Iliad, tells us at length of the wounding of Machaon by the arrow of Paris, and in another place is described some bad surgery of Machaon's, in which Menelaus, wounded by an arrow, was the sufferer. The Father of Medicine devoted a book, but unfortunately one of the lost books, to missiles and the wounds made by them. Celsus gives a chapter to arrow wounds, and from him we know pretty much all that is known of these lesions as they were seen in his day. Celsus lays down some excellent rules for the treatment of these wounds: thus he advises free dilatation with the knife, to allow perfect exploration by the finger, and teaches that an arrow may be removed as well and very often better by pushing it forward to emergence, than by pulling it back over the course already taken.[1] Paulus Ægineta[2] merely reiterates the teachings of Celsus, as does Albucasis.[3]

The ancients surpassed our Indians in the destructiveness of their invention, for they contrived arrow heads with barbs pointing forwards as well as backwards, and attached scraps of metal, which might be unwittingly left behind by the surgeon, if he should be so skilful as to extract a doubly-barbed arrow. They had, besides, a crescentiform arrow head with a keen edge, with which instrument a man could almost be decapitated.

Paré gives considerable space to arrow and spear wounds. In his day, the arrow was fastened to the shaft in two different ways. Most commonly, the arrow head at its base terminated in a spike, which was driven into the

[1] Medicinæ, lib. vii. cap. v.   [2] Lib. vi. cap. lxxxviii.   [3] Chirurgia, lib. ii.

wooden shaft, but other heads had thimble-shaped sockets, into which the wooden shaft was driven. Some of these last described were composed of several parts, one arrow head being nested over another, frequently to the number of five. Paré's forceps for extracting these arrow heads was shaped like a glove-stretcher. Its beak entered the socket, and, on pressing the handles together, made sufficient outward pressure to hold the foreign body during its extraction.[1] Grose[2] says that the English arrow was from twenty-seven to forty inches long, that its range was from 120 to 360 yards, and that English archers could easily shoot through an inch plank. Archers constituted a part of the English army as late as the time of the Great Rebellion, and several important battles were decided by the bow and arrow, the battle of Hastings being the most important of all; nor is it impossible that the bow and arrow may again become a military weapon, and a very formidable one, in the hands of cavalry.[3]

Arrow of the North American Indian.—The arrow of the North American Indian usually consists of three parts: a head, a shaft, and a band that binds head and shaft together. The *head* is made of bone, of iron, of one of the silicious minerals, or even of glass. The *stone* or *glass* arrow head is made by trimming a fragment of agate, flint, obsidian, or bottle glass, into a cuneiform shape. This is done by holding the fragment in the left hand, and breaking off its edges, bit by bit, by means of a bone having a shallow groove cut around one of its ends. The edge of the glass is caught in this groove, and the thumb is used as a fulcrum.[4] These arrow heads have no neck; they are about an inch long, and a third of an inch wide. They are fastened by gum into a notch, which is cut in a rod of wood eight inches long, and this again is fastened by gum into a reed thirty inches long; but so frail is the connection between head and shaft, that the Indian is obliged to take extraordinary care that they do not become separated in the quiver.[5] These heads are of course brittle, and if they strike a bone, they are sure to break. Mr. V., a paymaster and clerk, was thus wounded in the arm by an Apache arrow. The glass head struck the humerus, and broke into many fragments, which were a long time in coming away.[6] The *metallic* head is usually made from soft hoop-iron, by aid of a sandstone hone. This head is from half an inch to an inch broad, and from one to three inches long, and of the well-known shape; its edges are dull-sharp, like those of an oyster knife, and it has at its base a small quadrangular stem or neck for attachment to the shaft. Usually it is not barbed.

The *shaft* of the arrow is made from the sapling of the willow or dogwood tree. A bundle of these saplings is thrown into a warm pool, and soaked until the bark can be easily peeled off. Each sapling is then straightened in this way: Pieces of wood are first firmly lashed to the ends of the saplings, crosswise; one of these crosspieces is held between the feet, and the other is held in the hand; a to-and-fro, semi-rotary motion, as in trephining, is given to the crosspiece in the hand. Thus the fibres of the stick become

[1] Œuvres complètes d'Ambroise Paré, ed. par J. F. Malgaigne, tome ii. p. 183. Consult also Daniel, Historie de la Milice Française, tome i. p. 303. Amsterdam, 1724.

[2] Military Antiquities respecting a History of the English Army, etc., p. 268, 1801.

[3] On the shapes and sizes of the arrows of the Middle Ages, consult Hewitt, Ancient Armor and Weapons in Europe, etc., vol. i. pp. 23–65, 1865; also Matthew Paris, Historia Major, pp. 1090–1091. Paris, 1644.

[4] Consult Report of Explorations for a Route for the Pacific Railroad, on the trail of the 41st parallel, North Latitude. Senate Document, 33d Congress, p. 43.

[5] Consult Notes on Arrow Wounds, by Elliot Coues, Assistant Surgeon, U. S. Army. Medical and Surgical Reporter, April, 1866.

[6] Unpublished Notes of Cases in the Office of the Surgeon-General, U. S. Army.

untwisted, and it is easily made straight. It is then confined in this straight condition on a flat rock, by superimposed weights, until it becomes dry, when it remains straight. It is next cut to the length approved by the archer who has fashioned it, a length ranging from twenty-six to thirty-four inches. A slit is made at one end to hold the neck of the iron head, a notch at the other to receive the bow-string and the feathering that is to steady its course, and the shaft is done.

The third part of the arrow is the *clamp* that binds head and shaft together. This is a flat piece of sinew, or tendinous ribband. The neck of the arrow-head having been pushed into its place in the slit of the shaft, the well-soaked sinew is tightly wrapped around the joint. As it dries, it contracts, and so pinches together the sides of the cleft. Thus by its embrace, a bit of iron and an innocent stick are transformed into an inflexible, dangerous weapon, for, as will appear, much of the danger of arrow wounds depends upon this peculiarity of construction.

Bird Arrow.—The bird arrow, consisting of a simple shaft, its end pointed and hardened by fire, is sometimes used in war. Thus Mr. Evans was wounded in the top of his left lung by a bird arrow, which he plucked away at once. He died two weeks afterwards.[1]

Range and Penetration of Arrows.—Although the distance at which arrow fire is effective, is not great—being less than 100 yards—the penetrativeness of the missile itself, even at far range, is surprising. I have seen an arrow, discharged from the distance of an hundred yards, so deeply imbedded in an oak plank that it could not be removed by any force directly applied. I have often had occasion to notice the tightness with which an arrow-head is held, when it has penetrated a bone. It is usually impossible to remove it by direct traction. The Indian highly prizes this power of penetration, and increases it by skill and practice. An arrow which has been shot in the chase through the body of a buffalo, is carefully treasured and decorated, and, when worn on festal days, marks its owner as a man of the most worshipful skill. There are numerous specimens in the Army Medical Museum proving the

Fig. 225.

Fig. 226.   Fig. 227.

Penetration of superciliary ridge and brain by an arrow. (A. M. M., Sect. I. Spec. 5644.)
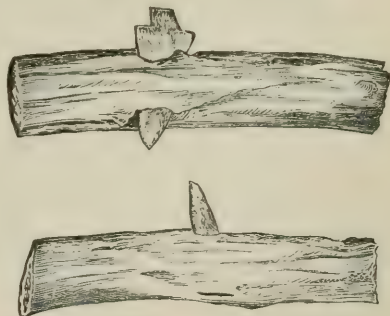
Ribs of buffalo transfixed by arrows. (A. M. M., Sect. I. Spec. 4735, 4736.)

penetrativeness of the arrow. Among these, I have selected three, represented in Figs. 225, 226, and 227. In the former, an arrow has gone through the thickest part of the superciliary ridge, and then four inches into the brain. Figs. 226 and 227 show ribs of the buffalo transfixed by arrow heads.

[1] Unpublished Notes on Arrow Wounds in the Office of the Surgeon-General, U. S. Army.

CORRECTNESS OF AIM AND RAPIDITY OF DISCHARGE.—The arrow can be aimed at fifty yards as correctly as the revolver, and can be shot nearly as fast. At close quarters, and in a *mêlée*, it is a weapon more to be trusted than the pistol. It is not common to find a man killed who presents but one arrow wound: usually he will have received three or four; I have counted thirteen in one corpse. In 1872, two Indian scouts were found dead near Fort Rice, the two having been pierced by thirty arrows.[1] An expert archer will easily deliver six arrows in a minute, for he does not aim with the eye, drawing the string to the shoulder, but simply points the arrow, both arms being extended, and the hand which holds the bow grasping at the same time a sheaf of arrows. These are not shot away wantonly, for their manufacture costs the lazy Indian too much work, but in the frenzy of the fray; just as a dog, when excited, will rend the victim which he ordinarily loathes.

POISONED ARROWS.—After a residence among a number of our Indian tribes, and careful reference to authorities, I am satisfied that the North American Indian does not use poison on his arrow, at least not designedly. It is probable that in those cases in which poison seemed to have been carried by an arrow, it has infected the arrow accidentally, as may easily occur in view of the squalor and disregard of sanitary requirements in which the Indian lives. When arrows are prepared for war by dipping them in blood, etc., I believe that this is done from superstitious motives—a baptism of *fetich*, as it were. But a consideration of the subject, as already set forth, and as will be further developed, will show that poison is not needed to make the arrow a most effective weapon; its silence, its penetrativeness, the difficulty with which it is removed, the rapidity with which it is discharged, and its correctness of flight, all confer upon it the highest deadliness. While this more particularly concerns the soldier, we shall find much in the character and treatment of arrow wounds to interest the surgeon.

APPEARANCE OF ARROW WOUNDS.—The arrow makes a wound which is at the same time punctured and incised. Thus, while on the one hand, owing to its high velocity, it rarely fails to lay open any viscus or to divide any vessel which it touches, it makes, on the other hand, a well-like wound, like that inflicted by the bayonet. But owing to its high velocity, the wounds made by an arrow oftener preserve their continuity (like gunshot wounds received at close range) than do bayonet wounds, which, as already pointed out, by becoming discontinuous, prevent the outward flow of discharges, and so give rise to abscesses. The cleanness of cut which characterizes arrow wounds also renders them less apt to suppurate than other punctured wounds. If an arrow has passed completely through a fleshy part, we find the two orifices differing in appearance. The wound of entrance looks like that made by a small pistol ball, a slit being found in the skin, which may be darkened and bruised, and slightly depressed. The wound of exit is a simple slit. When only one wound is found, the shaft having been plucked away, a question may arise as to whether the injury has been caused by an arrow or by a bullet.

After the attack by Navajoe Indians on Fort Defiance, in 1860, a soldier was found dead with a small wound just below the left nipple. The external wound looked like that made by a small conical ball, and it was thought that the man had met his death in a gambling quarrel at the hands of his comrades. But an examination of the interior of the chest showed that the vena cava was pinned to a rib by an arrow head, which had also passed through the heart. In all probability, the shaft had been removed by the archer.

[1] Unpublished Memoranda in Office of Surgeon-General, U. S. Army.

An arrow may make a simple incised wound, several inches in length. Thus, if an arrow head strikes the skin obliquely, particularly at some spot where it is closely drawn over bone—as over the ulna, the tibia, or the cranium—a long cut with clear edges will result.

PARTS OFTENEST WOUNDED.—In the annexed table is shown the liability of the several regions of the body to be wounded, and the relative fatality of these wounds :—

| | Head or spinal column. | | Neck and trunk. | Thorax. | | Heart. | Abdomen. | | Upper extremities. | Lower extremities. | Total. |
	Contents wounded	Contents not wounded		Lung wounded	Lung not wounded		Cavity penetrated.	Cavity not penetrated.			
Recovered .	2	4	12	5	10	...	2	11	44	17	107
Died	7	...	1	13	...	2	18	3	2	1	47
Cases. . . .	9	4	13	18	10	2	20	14	46	18	154

The above table is founded upon some seventy cases of arrow wound which fell under the notice of the writer in 1860, and an account of which was published in the American Journal of the Medical Sciences for October, 1862, together with other cases which have occurred since—some reported to the Surgeon-General of the United States Army, and published in Circular No. 3, S. G. O., 1871; others as yet unpublished; and five reported in the Philadelphia Medical and Surgical Reporter for January, 1864, by Assistant-Surgeon Elliot Coues, U. S. Army.

The *upper extremity* is oftenest wounded, not only because it is most exposed, but also because an arrow can be seen as it advances, and the arm, being instinctively raised to ward off the missile, thus receives its point. Wounds which penetrate the *abdominal cavity*, and injure its vessels or viscera, are the most fatal. Knowing this, the Indian, if he has time to deliberate, points his arrow and lance at the abdomen, while the Mexican protects this part with special care, by covering it with many folds of a blanket. As already stated, multiple arrow wounds are the rule. In the above table, in each case in which there were multiple arrow wounds, the most serious, or the fatal wound, only is recorded.

CAUSES OF DEATH.—The following table exhibits the causes of death in thirty-nine cases of arrow wound, in which this was ascertained :—

Cause of death.	Immediate hemorrhage.	Peritonitis	Compression of brain.	Encephalitis.	Empyema.	Tetanus.	Pneumonia.	Paralysis from wound of cord.	Wound of heart. (Shock ?)
Number of cases	10	16	4	3	1	1	1	1	2

PROGNOSIS.—The prognosis in a case of arrow wound depends on several circumstances. It is influenced, in the first place, by the *nature of the parts wounded*. Vessels and intestines are not pushed aside, as they frequently are by bullets, but are laid open; fecal matter may be thus thrown into the peritoneum, or a hemorrhage, sufficient to determine the fatal issue, may take place before the case is seen by the surgeon. Not only have we to consider the blood already lost, but that which is likely to be lost in extracting the

missile, or in securing the wounded vessel. The first of the preceding tables shows, however, that arrow wounds of the abdominal cavity are not invariably mortal. Secondly, in considering the prognosis, we should regard the *chances of extricating the arrow head*, if this has lodged. If the shaft remains attached to the head, the operation will probably be successful ; but if the head is lost in the soft tissues, or is left in the chest or abdomen, its removal will be difficult and perhaps impossible. If, however, the foreign body be not extracted, it will sooner or later bring about the death of the patient, for, unlike a smooth ball, the arrow head—long, sharp on the edges, angular, perhaps serrated—will not become encysted. Other considerations, too, not peculiar to arrow wounds, affect the prognosis; such as the health of the patient, the immediate importance of the wounded parts to life, the liability to inflammation, and especially the courage or mental serenity of the sufferer. The presence of shock shows that an organ essential to life, or highly innervated from the sympathetic system, has been seriously hurt, for ordinarily there is no shock at all. Wounds of the joints generally do well, and destructive inflammation of the synovial membranes is not likely to occur.

TREATMENT OF ARROW WOUNDS IN GENERAL.—If an arrow has struck a fleshy part, such as the outer side of the thigh, and has *passed completely out*, but little need be done. The wound should be encouraged to heal by first intention, and to this end perfect rest, both general and local, should be enforced. If a limb is hurt, it is well to place it on a light splint, and to apply a bandage firmly, so as to quiet muscular action. On the high, dry tablelands of Colorado and New Mexico, these wounds will often heal in two or three days. Hæmatomata may form, but, even under these circumstances, we may frequently get absorption without the formation of pus. If an abscess has formed, it should be opened according to general rules.

If the whole arrow—head and shaft still bound together—has *lodged*, we must first determine whether or not the head is impacted in the bone. This can be ascertained by gently twirling the shaft between the finger and thumb, or by trying to push it a little forwards—never by pulling it back. The slightest mobility settles the question, and the greatest care must be taken not to separate the head and shaft in the examination. If the head is not fixed in the bone, we next consider whether the missile shall be *pulled out* over the course it has already taken, or whether it shall be *pushed out* through the tissues which it would have traversed, had its progress not been arrested. This will depend upon how deeply the missile has penetrated, and upon what tissues it must encounter in a forward course. If it is decided to *push* out an arrow, we oil the shaft, and make firm pressure on its end. When the head is felt under the skin, it should be released by a touch of the knife. The head and tendinous ribband are then removed, when the shaft is withdrawn with a gentle rotary motion. In this case too, where we artificially make the arrow do what it would have done had its progress not been stayed, we get a cure without suppuration. But if the ribband of tendon has been left in the wound, or if, for any reason, such as inability to secure rest for the parts, we expect suppuration, then, before withdrawing the shaft, it is well to fasten to this a drainage-tube, and to drag the latter into the wound as the former is plucked out. Some carbolized oil may be injected into the tube, which should be left in place until suppuration commences ; then the tube with a pledget of lint may be drawn through the wound, and the missing tendinous ribband be thus brought away. Further search for this will usually be inexpedient.

If it is not feasible to *push* the arrow out, we must *pluck* it out, and, to do this, the head itself must be seized. But the shaft is so tightly grasped by

the skin and other tissues that not even a probe, much less the finger or forceps, can be carried down to the head. A deep incision, using the arrow shaft as a guide, must therefore first be made with a probe-pointed bistoury, sufficiently free to permit the finger to pass down and touch the arrow head. After the position of the latter has been ascertained by the finger, a pair of long dressing forceps, applied to the flat sides of the head, will suffice for its removal. I would urge that this should be done with the greatest care, lest the head should be separated from the shaft. So easily may this accident occur, and so unfortunate are its results, that this manœuvre with the forceps must always be a matter of anxiety to the surgeon.

If the arrow head is deeply lodged, or if it has penetrated the chest or abdomen, some other instrument than a dressing forceps will be necessary. If the arrow forceps, to be presently described, is not at hand, a loop one-quarter of an inch in diameter should be made on a stout wire, and this loop, having been bent at right angles to the body of the wire, should be carried down beyond the point of the arrow head, and so manipulated as to snare the latter. In doing this, a forked probe, like that used in the operation for vaginal fistulæ, or the old fashioned *porte-mèche* (Fig. 40, Vol. I. p. 481) will be of the greatest assistance. Fig. 228 shows the application of the loop to

Wire loop applied to arrow head.

the arrow head. When the loop has embraced the head with a very gentle pressure, the wire should be firmly lashed to the shaft of the arrow, and then gentle traction should be applied to this, the finger being kept as deeply in the wound as possible. It is best not to pull directly on the wire itself, but to use this only as a kind of clamp, to make the arrow head fast to the shaft, making traction on the latter. In this way, if any tissue which it is desirable not to cut, should be pinched between the wire and the edges of the arrow head, it will be less likely to be wounded. As soon as the head is drawn within reach of the finger, the dressing forceps should be applied. The loop should be used for arrow heads not lodged in bone, only to draw the missile within reach. In making the incision with the bistoury, it is better to make it too large than too small. It must allow perfect freedom for the manipulation of any instrument, and especially for that best of instruments, the index-finger.

If the arrow head has *lodged in a bone*, and the arrow forceps is not at hand, the wire loop must be applied in a different way, and considerable force may be required to unseat the foreign body. The shaft in this case should be cut off with pliers, the wound well dilated, and, if possible, the position of the arrow head ascertained with the finger. Then a loop of stout but flexible wire—the ends being threaded into a Coghill's suture twister—is slipped over the remnant of the shaft, and, by means of the twister and a *porte-mèche*, is pushed down until it has passed over the arrow head, which it is made to encircle loosely. The wires are then drawn tight and fastened to the handles of the twister, and the latter having been rotated once or twice, the loop will be firmly attached to the head, from which it cannot slip owing to the wedge shape of the latter. Figure 229 shows the application of the twister and loop. The arrow shaft and the twister having been lashed together, the two may be gently twisted or rocked from side to side as one system, whilst traction is made by the handles of the twister. If force enough be used, and if the wire do not break, the arrow head will come out. If the wire should

appear too weak, and likely to break, a second loop should be cast around the head by means of another twister, before traction is made. Any amount of force may be applied by fastening both twisters to an inflexible rod, one end of which rests upon a block placed upon the patient's body, and then using this rod as a lever of the second order. Force is thus applied evenly and

Fig. 229.
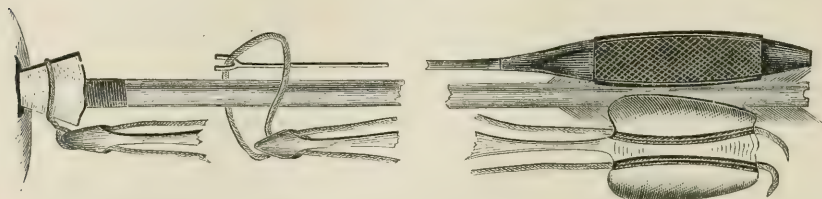
Application of wire loop to arrow head embedded in bone ; the loop is adjusted by aid of the wire twister and *porte-mèche.*

without jerking. The *écraseur* and wire cable used for crushing piles, or two catheters soldered together, may be used instead of the twister, though this can be made by any blacksmith.

I think, however, that the forceps which I have devised for extracting arrows, will be found more convenient in all cases than any arrangement of loops. The instrument is represented in Fig. 230. The jaws are flat, and are

Fig. 230.
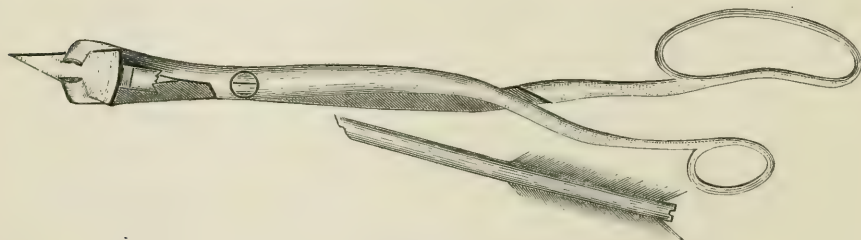
Strong forceps for extraction of arrows.

bent at right angles to the handle, and they form, when closed, an elliptical loop adapted to embrace the head as a dagger is embraced by its sheath. For convenience and certainty of passing these forceps down to the arrow head, the face of the jaws, close to their edges, is grooved so as to fit and slide along the round arrow shaft, which is thus used as a director. The joint is made like that of a dentist's forceps, so as to allow of any amount of twisting without bending, and, in order to make the instrument still stronger as a twister, one of the handles is mortised, and into this the other handle is made to fit, being tenon-shaped through nearly its whole length. The handles are eight inches long to the fulcrum, and are made very strong in themselves as well as by their mortise and tenon construction. From the tip of the jaws to the fulcrum is two and a quarter inches. When the arrow shaft is in place, the instrument is slid down upon this as a director, until the head is reached, when the jaws are opened, and made to grasp the head by its edges, encircling it almost like a loop. The handles having been then tied together for security, a gentle but decided twist will unseat the arrow head as easily as a dentist twists out a bicuspid tooth. If the head is not lodged in bone, the forceps are passed, closed, beyond its point, and the jaws are used as a loop to catch the latter without being opened at all.

The removal of an arrow head *after the shaft has been separated from it*, is always difficult, and frequently impossible. The ancient writers rather made light of arrow heads hidden in the tissues, and there are, in the Army Medical Museum, at Washington, specimens of flint arrow heads, lodged and encapsuled in bone. But who can say what trouble these foreign bodies may not have given during life, and whether they may not have been, indirectly at least, the cause of death? In my own experience, as well as in that of several of my colleagues, the lodgment of an iron arrow head in soft tissues or in bone, will ultimately produce fatal mischief. I have never seen an arrow head left behind after the withdrawal of its shaft, but it sooner or later required removal, to preserve limb or to save life. In 1862, in an article which I published in the American Journal of the Medical Sciences, I wrote: "An arrow head cannot become encysted like a ball; it presents too many sharp angles and edges, and is generally too irritating for any such event to be expected. . . . . The inflammation it produces is the effort of nature to throw off the foreign body." I might have added that this inflammation will continue as long as the patient lives, unless the foreign body be thrown off by nature, or removed by art.

The case of the late General (then Lieutenant) Bayard, of the U. S. Cavalry, as narrated by Dr. C. A. Pope,[1] may be quoted in illustration of this doctrine, and may serve to exemplify the characteristics of a case of arrow wound in which the head has lodged:—

The spear-shaped iron point, two and three-quarter inches long, . . . entered the face a little below the orbit, and was completely embedded up to the shoulder, the small neck alone remaining in the flesh. Its direction was backwards and slightly outwards. The surgeon of the Post immediately endeavored to extract the foreign body; . . . various means with forceps were resorted to, and, after a trial of two hours, the effort of extraction was abandoned. The absence of a suitable instrument, the slight hold which could be obtained on the offending body, and, above all, the firm impaction, sufficiently accounted for the failure. (Slight secondary hemorrhage from the nose followed within a few weeks, and again a more serious bleeding occurred while the patient was on his way home.) The patient arrived at St. Louis five weeks after the receipt of the injury, and I visited him immediately. There was some enlargement of the left side of the face. The wound on the cheek had skinned over, so that no foreign substance could be seen; . . . a muco-purulent discharge, which came doubtless from the antrum, issued from the corresponding nostril. On incising the imperfect cicatrix, I felt the small neck, and, supposing that the arrow head, after so long a time, might be loosened, I attempted its extraction with the dressing forceps of my pocket case, but failed. I at once supplied myself with instruments of various kinds, but succeeded in the first attempt with powerful forceps. A smart hemorrhage from the nostril and external wound immediately followed. By rest, cold, the administration of opium, plugging, and bandaging, the bleeding was soon arrested. The case now seemed to progress favorably, and the patient was able to get about the streets. On a visit to my office, he complained of a stiffness and inability to open his jaws as widely as usual—a difficulty indeed which had existed all along, and which was the result of the general thickening of the parts from inflammatory exudation. I advised him to make gentle efforts to open the mouth. In less than an hour from this time, his troubles commenced. The whole cheek became hot, swollen, and painful. High fever with renewed bleeding set in, and caused me much anxiety. The means which before were successful, now failed. Extensive extravasation of blood took place, and, to relieve the tension, I made an incision in the mouth, and others on the cheek and neck, thus allowing the discharge of large grumous clots. The hemorrhage continuing at intervals, occurring with regularity about twelve o'clock on three successive nights, and the patient being reduced to the lowest point of safety, I determined to tie the carotid artery without delay. This was done by candle-light on the night of the 16th of September, two

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[1] St. Louis Medical Journal, 1864, p. 12, and Hamilton's Military Surgery, p. 544.

months after the receipt of the injury. (The operation, though done under the most unfavorable conditions as regarded its time and the state of the patient, was successful. The bleeding never recurred, and the final recovery of the patient was complete.)

Let it be received then as a rule without exception, that an arrow head left behind and lodged in the tissues must be removed as soon as possible, even if this removal should require the severest and most dangerous of operations. Accordingly, as soon as a patient presents himself, and, if possible, before the wound made by the shaft and head has closed, search should be made for the foreign body. A probe should be introduced, and carried along the course of the wound as far as possible, until the arrow head is reached. If a false passage is made, the probe should be left where it has lodged, and a second one taken, and this manœuvre repeated until the true passage is found. Of course the patient is placed in the attitude which he held when wounded, and the wound itself is injected with carbolized oil, so as to deaden sensibility and diminish reflex muscular action. If the probe has penetrated for some distance into the tissues, and if, though we feel sure that it has followed the course of the wound, its progress has become arrested, it is well to lay the wound open to the depth reached by the probe, using this as a guide. At the bottom of the wound so made, we may be able to find again the track of the arrow, or perhaps to feel the head with the finger. In any event, such a wound is of trifling consequence in comparison with the important result that may be got from it. But sometimes the most patient and boldest searches fail to discover the arrow head. There is then nothing to do but to wait. Perhaps an abscess will form, and in it we may find the offending body. To save life, it may be necessary to amputate the limb.

In these searches for hidden arrow heads, it should be remembered that the course of the arrow is always straight through the tissues, and that therefore an incision carried down in the direction which the arrow had on entering, will reach its head. There is greater hope then from exploratory incisions in arrow wounds than in gunshot wounds. But even if the probe, successfully carried through the wound, should strike the iron head, still, there might be doubt. The foreign body is small and light, and usually presents, not its flat side, but its sharp edges to the contact of the probe. The finger only can give certainty, and to apply this instrument a long, deep incision may be necessary. Before making this, however, and in order to avoid doing so, a plan that I have practised, though unsuccessfully, may be tried. A pair of long, slender forceps may be introduced alongside of the probe, and carried on until the body supposed to be the arrow head is reached. Then the forceps are opened, and an effort is made to cause its jaws to strike the flat side of the head, one jaw above and the other below, the head lying between them as the forceps are shut and opened. The trouble which I found in this exploration, was to manipulate ordinary forceps in so deep and narrow a wound; but the modification of the Mathieu "crocodile" forceps which I have had made for extraction of balls (Fig. 231), would probably answer the purpose.[1]

If the head has been found, no hesitation or delay should occur in extract-

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[1] The magnetic probe of the writer may also be used with advantage in these cases of doubt. It consists of a steel probe, made from a coarse knitting needle, highly magnetized. Over one of the poles is wrapped from seventy-five to a hundred feet of No. 40 insulated copper wire, so as to form a spindle-shaped bulb, about an inch long and from a fifth to a quarter of an inch in diameter. This bulb is covered with catheter varnish, or asphaltum varnish. The steel magnet projects from the bulb from an eighth to a sixth of an inch, according to the length of the probe. The wires from the bulb are connected with the audient of a telephone. On touching the end of the magnet which projects beyond the bulb, to a bit of iron, a momentary, induced current of electricity is, at the time of contact, developed in the coil of wire forming the bulb, and this current, passing to the audient, manifests itself there by a grating click. (See American Journal of the Medical Sciences, January, 1881.)

ing it. Ordinarily the arrow forceps, applied to its edges, will bring it away safely enough, even without an incision. If the head is lodged in bone, the forceps should be used as the dentist uses the bicuspid forceps, giving a slight twist to unseat the foreign body, before making traction. I reiterate,

Fig. 231.
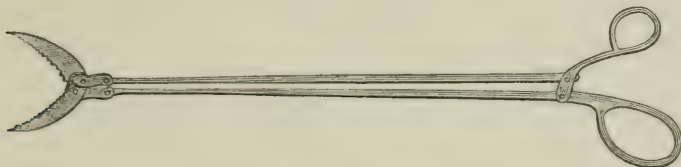
Modified "crocodile" forceps.

and would lay it down as a cardinal rule, that an arrow head must never be left in the body, unless patient search has failed to find it. I wrote in 1862, and think yet: "We might as well cut the patient's limb up until we do find the arrow head;" for, if it is left, amputation will be necessary, and worse than this can hardly ensue from the dissection advised. If I should undertake such an operation, I would make up my mind to find the arrow head, even if it became necessary to tear up every fasciculus of every muscle in the injured member.

Before leaving the general consideration of arrow wounds, I should mention a complication peculiar to the lodgment of the iron arrow head, a complication which renders its extrusion by natural processes impossible, and its extraction by art very difficult. If a soft iron arrow head strikes a bone obliquely, or slips between it and its periosteum, or if the muscles contract as the shaft passes through them—the point of the head being at the same time in some dense tissue, such as bone or cartilage—the point is bent. This bending increases as the arrow goes on, until at last the whole head will have been transformed into a hook. A little reflection will show how powerless the wounded part must be to throw off the intruder, and how hard it will be to remove it by forceps, unless we make allowance for its change of shape. The appearance of an arrow head thus distorted is represented in Fig. 232, from a case reported by Surgeon B. A. Clements, U. S. Army.[1] In a case occurring in the practice of the late Dr. Kennon, of Albuquerque, New Mexico, the femur was found half encircled by a hoop-iron arrow head, which had produced caries, abscess, and infiltration, and was only removed at last after a severe operation.

Fig. 232.

ORIGINAL SHAPE.

PROFILE.

Bending of arrow heads. (After Clements.)

The chance in any given case that the arrow head may have been thus bent, gives additional force to the rule of always searching the wound with the finger as a probe.

Unless the surgeon sees the patient very soon after the plucking out of

[1] Hamilton's Military Surgery, p. 530.

the shaft, he will probably fail to find the foreign body. To leave the shaft intact, or to cut it off carefully an inch from the surface, for convenience of tranportation, is the safety of the patient. Soldiers, or those liable to be wounded by arrows, should understand the danger of meddling with an implanted shaft, and every effort should be made to keep this in its place until proper surgical aid can be given. Not only is the presence of the shaft necessary for the easy finding of the head, but it will be the best guide in case it should be necessary to cut for and tie some wounded vessel.

TREATMENT OF WOUNDS OF SPECIAL PARTS.   *Nerves.*—If a nerve has been partially divided, or if such an accident is suspected, it is right to cut down to the nerve supposed to be injured, and complete its division. Our knowledge of the cutaneous distribution of the nerves will aid us in determining the particular nerve which has been hurt. Thus, in a case which I saw in 1860, in which an arrow passed through the middle of the leg, I inferred from the intense pain felt in the fibular side of the foot, that the musculo-cutaneous nerve had been injured, and a small incision showed that nerve to be partly divided. I completed the division with the knife, giving immediate relief from pain, and without producing permanent inconvenience to the patient. I think that this would be the correct treatment even if a nerve as large as the sciatic were partly divided.

Wounds of Vessels.—If an arrow divides or wounds an artery or vein, and the hemorrhage demands it, we must search for the bleeding point, using the shaft as a director. Then we should act according to circumstances. If the vessel be a small artery or vein, its complete division will probably check the hemorrhage. If the ligature is required, we must apply the thread both to the cardiac and to the distal end of the divided artery; it is well to knot the ligature belonging to the cardiac end, for purposes of distinction. As long as the shaft remains in the wound, there will be little hemorrhage, especially if a bandage be rather tightly applied to the limb, the shaft serving as a means of making pressure on the wounded vessel.

Arrow Wounds of Joints.—Usually arrow wounds of the joints do very well, but I can imagine a particular case which would involve the greatest danger. If an arrow shot with force should deeply penetrate the cancellous structure of the femoral condyles, and bury itself so deeply as to make the grasp of forceps unavailing—the joint of course being implicated—the patient would be in the greatest peril. He would probably die if the foreign body should not be removed, and it could be removed only by a resection of the joint, or by amputation. Although I have never seen such a case, it might well occur, for an arrow head could readily penetrate so deeply into the thigh bone that not even the neck of the weapon would project. Perhaps in such a case the best course would be to employ expectant measures during the acute stage, and resort to secondary excision at a later period.

Arrow Wounds of the Head.—If an arrow strikes the calvaria at right angles, it will penetrate, provided that it has not lost its momentum,— the danger to the patient depending upon the depth of penetration and the locality of the wound. If one of the large sinuses or the important parts of the brain be injured, immediate death may follow. So perished Lieutenant Maxwell, of the Second U. S. Infantry, by an arrow wound of the superior longitudinal sinus. There are numerous specimens in the Army Medical Museum showing arrow wounds of the calvaria. In specimen No. 5644, represented by Fig. 225, the arrow went through the thickest part of the

superciliary ridge, and penetrated deeply into the brain, and yet its presence was hardly suspected during life. If an arrow has penetrated but a short distance—as a quarter of an inch—into the skull, and the patient has symptoms of cerebral compression, the probabilities are that a scale of bone from the vitreous table has been broken off, and, still sticking to the point of the arrow head, is making pressure on the brain. I have seen a patient with an arrow slightly penetrating the skull, immediately recover consciousness on the removal of the foreign body. It is probable that, in plucking out the arrow head, I drew back into its place a scale of bone which had been broken off from the inner table, and driven in against the brain. In two other cases of arrow wound of the skull—not, however, seen during life—I found by an autopsy that this depression of the inner table had occurred. The scale of bone was in each case spiked by the arrow point, and borne firmly against the dura mater and brain. The men had evidently been rendered insensible by the wounds in their skulls, for both had perished from other wounds received at close quarters. I think that this casualty is of rather frequent occurrence, and although there is no example of it in the Army Medical Museum, it must be remembered that this accident would immediately render the wounded man a prey to the savage who had shot him, and, after being scalped and otherwise mutilated, he would be left dead on the field, or possibly buried where he fell. Thus it would not be probable that any specimens would be procured.

The immediate danger in arrow wounds of the skull, is from internal *hemorrhage;* and we infer that this has taken place if the symptoms of compression remain after the arrow head has been withdrawn. If the arrow head has gone in very deeply, a large trephine should be applied, and the circle of bone and arrow head may then come away together. Next, any superficial bleeding vessels should be looked for, and twisted, or, if they are lodged in bony canals, such as the meningeal, the wound should be plugged with lint. The exposure of the deeper parts to the air would at once give outward vent to the blood, thus relieving the compression, and at the same time constringing the vessels and so stopping the hemorrhage.

Encephalitis is the secondary danger to which the victims of arrow wounds of the skull are exposed. If the arrow head is removed, this inflammation will usually not be serious, and will yield to purgatives, ice, aconite, and rest. But if the arrow head is not removed, the irritation will produce abscess, which will probably prove fatal. In these cases the patient is usually conscious, and perhaps unaware that an arrow head is lodged in his brain, and quite skeptical as to the ultimate danger. If, after a cautious examination with the probe, the surgeon cannot find the missile, the case must be left altogether to nature. Should chronic inflammation be developed, as indicated by pain and delirium, and more particularly should abscess form, as indicated by stupor, it might be right to trephine. The pus might thus possibly make its escape, or, by rare good luck, the arrow head itself might be found.

Arrow Wounds of the Face.—Arrow wounds of the face are often attended with considerable hemorrhage, both primary and secondary. They are troublesome, also, on account of the sponginess of the bones, which permits the arrow to penetrate deeply, and then, by allowing the part to close over the head of the missile, opposes obstacles to its extraction.

Fig. 233, from Circular No. 3, S. G. O., 1871, represents a skull in which the arrow entered just above the zygoma, and, passing inwards, penetrated the brain through the temporal region. The shaft of the arrow had been plucked away, leaving the arrow head deeply embedded and entirely hidden in the temporal muscle, and hooked under the zygoma by one of its shoulders, so that its pres-

ence was only conjectured by the surgeon. The specimen shows what difficulty would have attended the extraction of the foreign body, wedged down as it was under the zygoma, at its base, and penetrating into the skull as it did by its point. The specimen and the history of the case are demonstrations of the advantages in all cases of thorough digital exploration, not merely to determine the presence of an arrow head, but to enable the surgeon to decide what manœuvre will best serve for its safe removal. In the above case, it would probably have been necessary to resect the zygoma, in order to get enough of the arrow head exposed for the grasp of the forceps. The man survived the injury about a month, and was, during most of this time, without threatening symptoms.

Fig. 233.

Arrow wound of temporal bone with entanglement of arrow head by the zygoma. (A. M. M. Sect. I. Spec. 5907.)

Arrow Wounds of the Neck.—This part of the body is often wounded, but, as the table on page 107 shows, not with serious effects. Yet if the great vessels should be wounded, or the trachea spiked to the vertebral column—injuries not unlikely to be met with—the case would in all probability end fatally. I have never seen such an occurrence, but it is in tradition that Conrad of Lorraine, having removed his helmet at the moment of victory over the Hungarians, received such a wound, and speedily died.

Arrow Wounds of the Chest.—Arrow wounds penetrating the chest and wounding the *lung*, although serious, are by no means necessarily mortal injuries. The table shows that in 18 such cases, there were 13 deaths, or about 72 per cent. The lung does not collapse after an arrow wound, as it is apt to do after a wound made by a ball, for the arrow shaft is tightly grasped by the cutaneous tissues, and the integrity of the pleural vacuum is preserved. But in this very collapse and contraction lies the patient's safety against bleeding, and hence arrow wounds of the lungs are apt to be attended with internal hemorrhage, which, if at all profuse, leads to almost immediate death by apnœa. If the patient survives the period of hemorrhage, the prognosis is favorable, for the consecutive inflammation is usually trifling, and requires no treatment beyond placing the patient at rest, and affording a supply of pure warm air. If the head of the arrow has been left in the lung tissue, nothing probably can be done for the patient. Only the most superficial examination with the probe is allowable. The patient will probably die with hectic, in the course of six weeks, or, if he survive, will remain an invalid all his life. If the shaft has not been removed, the external wound should be cautiously dilated with bistoury and finger, and the arrow head then snared by the bent loop, or grasped by the arrow forceps, and withdrawn. The loop is the better instrument in these lung cases. The greatest care should be taken not to detach the head from the shaft, for if this should happen, and the head be lost, the patient would almost certainly perish.

If an arrow has passed from one side of the chest to the other, as from the breast to the back, it is better to push it on, and make it emerge through an intercostal space, than to draw it back. If it is lodged in a rib, after traversing the chest from side to side, the point of this lodgment must be ascertained by gently striking the feathered end of the shaft whilst the fingers of

the other hand are passed backwards and forwards over the rib until the point of greatest impact is determined, this, together with the direction in which the shaft points, fixing the position of the head. The rib is then to be trephined at this point. If an *intercostal artery* has been wounded, the application of the actual cautery is the most convenient means for arresting the bleeding: I have used a bent nail, heated, both in intercostal wounds and wounds of the inferior dental artery. Or the whole rib may be encircled by a ligature passed around it with a bent probe, or with a Gibson's aneurismal needle, or with the blunt needle of the chain saw.

An arrow transfixing *both lungs*, or the *heart*, would, if it lodged, necessarily cause immediate death. If it passed out at once, as it sometimes does through the chest of the buffalo, the patient might speedily recover.

In wounds of the chest, if the *pleura* should fill with blood, this should be removed by the aspirator, if possible. If the blood is clotted, it might perhaps be rendered fluid by the injection of a solution of pepsine, as in the case of vesical coagula. Pus in the pleural cavity always requires the use of the aspirator, but empyema is not a common result of arrow wounds.

Arrow Wounds of the Abdomen and Pelvis.—Arrow wounds of the *abdomen* are generally fatal. Not only is there a liability to peritonitis from fecal extravasation, but the wound is apt to be immediately fatal from hemorrhage. But all wounds of the abdominal cavity are not followed by death. The table on page 107 shows two recoveries in twenty cases, a mortality of 90 per cent. In a very interesting case under the care of Surgeon Forwood, U. S. Army, and described in Circular No. 3, S. G. O., 1871, a large calculus which had formed upon an iron arrow head was removed from the *bladder* of an Indian. This man had been shot in the buttock while mounted, and at close range. The shaft of the arrow had been withdrawn, and the head was left behind in the bladder. The man made a good recovery.

The *treatment* of arrow wounds of the abdomen consists in the removal of the missile; the checking of bleeding, by torsion or otherwise; the suturing the intestine, if wounded; the thorough cleansing of the part from excrementitious matters; and the enforcement of rest. An incision should be made sufficiently large to admit the finger, and when the position of the arrow head has been determined, it is to be seized with forceps, and removed. If the shaft has been plucked away, the chance of finding the head is very slight; but the attempt should be nevertheless made, and if fecal matter is found in the cavity of the abdomen, no hesitation should be felt in laying this open and searching thoroughly for the foreign body. Bleeding points should then be twisted, and the intestine, if wounded, sewed up. Very fine carbolized catgut should be employed for this purpose, and it is of comparatively little importance what particular form of suture is used, so that the operation is finished with as short an exposure to the air as possible. The parts, having been cleansed with water containing a little salt and egg serum, are to be carefully returned, and then the incision in the abdominal walls is to be secured by figure-of-eight sutures passing through the muscles as well as through the integument. Opium should be given to stupefaction, and the patient kept under its influence for several days, or until the pulse loses the characteristics of peritoneal inflammation. Any one who has used opium in this way will agree with me, I think, that it possesses, over and above its power of enforcing rest, a specific power of preventing or subduing peritonitis. If any outward application is to be made, I should prefer moist heat, applied by means of large bran poultices. But it must be remembered that, unless frequently renewed, and kept very hot (about 110° F.)—yet not too hot, for the patient, being nearly insensible, may easily be burned—they will

do harm. A trusty and intelligent corps of nurses is indispensable, if heat is to be used in this way. After the primary danger of peritonitis is past, the patient should be kept in the horizontal posture for a month, and fed chiefly on beef, or mutton, or fowl, to which it will be prudent to add some pepsin. Olive oil will keep the bowels in a proper condition.

In concluding the subject of arrow wounds, I would briefly recapitulate as follows :—

(1) An arrow head must be removed as soon as found.
(2) In the search for the arrow, extensive incisions are justifiable.
(3) An arrow may be pushed out as well as plucked out.
(4) The finger should be used for exploration in preference to a probe.
(5) Great care must be taken to avoid detachment of the shaft.
(6) Healing by first intention should be encouraged.
(7) The surgeon should strive to comfort the patient. Although arrow wounds are not attended with much shock, they are usually the cause of great depression of spirits. " The constitutional disturbances following these wounds . . . are liable to be out of all proportion to the apparent amount of damage. There are almost always considerable . . . sleeplessness and great irritability, dejection of spirits, and intolerance of pain. The tendency to despondency becomes frequently a prominent symptom, to be carefully combated, and everything should be done to cheer the patient."[1]

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[1] Coues, loc. cit.

GUNSHOT WOUNDS.

BY

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GUNSHOT WOUNDS, as declared by John Bell, are " of most desperate nature, more various than can be imagined, to which all parts of the body are equally exposed." Their frequent occurrence, their danger, and the influence of correct diagnosis and proper treatment upon their progress and result, render the consideration of these injuries of the highest importance to every surgeon, in civil as well as in military practice. Whether produced by small or large shot, by bullet or shell-fragment, or by some one of the much less commonly met with vulnerating bodies (percussion-cap, portion of gun, piece of stone, etc.), directly or indirectly propelled by the explosion of gunpowder, they are, with almost no exceptions, to be classed under the head of lacerated and contused wounds. Their gravity varies according to the importance of the part injured, and to a considerable extent is proportionate to the size and velocity of the missile. Other things being equal, a perforating wound of any part is less dangerous than a penetrating one in which lodgment has taken place, and a large shot, though moving at a low rate of speed (when nevertheless the momentum is great), may produce extensive damage.

MISSILES.

As met with in civil life, these wounds are usually produced by small shot or pistol balls; very occasionally by parts of an exploded piece, by cap, by wadding, by cartridge-shell, or by ramrod. So-called "shot" vary in weight from 133 grains (the largest buck-shot) to as low even as less than one-fifth of a grain (2700 to the ounce), and pistol balls from 25 + grains to 350 grains, of a diameter ranging from .22 up to .50 of an inch. The U. S. service revolver bullet has a diameter of .458 inch and a weight of 230 grains. The heat of the powder explosion may at times fuse a bird-shot charge into a single ball of nodulated exterior. In military surgery, the great majority of wounds result from rifle bullets; quite a number from shell fragments or case-shot balls; some, but not many of those coming under treatment, from solid shot or unexploded shells, and, as in siege operations, from grape-shot. In battles fought in the open country, about nine-tenths of all the wounds received are from bullets—91 per cent. among the Germans in the Franco-German war (Fischer), 94.2 in the Italian campaign of 1859 (Longmore); in siege operations and assaults upon fortifications, the relative proportion of large shot, shell, and grape injuries is, as might naturally be anticipated, very much higher—in the Crimean war about 46 per cent.

(119)

With the use of the modern arms of precision, the old-fashioned round balls, of ¾ to 1½ oz. weight each (Fig. 234), have almost entirely disappeared as vulnerating bodies, except as secondarily projected by the bursting of case-shots filled with them.   The muzzle-loading smooth bore, with the single

Fig. 234.   Fig. 235.   Fig. 236.   Fig. 237.   Fig. 238.
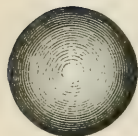
Round musket ball.   Springfield rifle ball.   Enfield rifle ball.   Ball for Snider gun.   Ball for needle-gun.
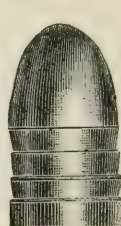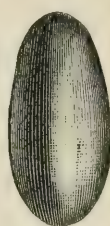
ball or " buck and ball" cartridge, is as much a thing of the past as " brown Bess" herself.   The service bullet of to-day, long and generally conoidal (Figs. 235, 236, 237)—egg-shaped in that used with the needle-gun (Fig. 238)—has a diameter of from .41 to .45 inch, and weighs from 315 to 480 grains.   The Swiss magazine-gun bullet measures .41 inch, and weighs 315 grains; the Russian .42 inch, 375 grains; the Austrian .425 inch, 318 grains; the French .45 inch, 380 grains; the Bavarian .45 inch, 340 grains; the Prussian .45 inch, 380 grains; the English .45 inch, 480 grains; and that of the United States .458 inch, 405 grains.   In the English and American service the bullet is made of hardened lead—13 parts lead, 1 part tin (English); 16 parts lead, 1 part tin (American)—and such bullets may perhaps do less damage than those of soft lead, though it must be remembered that in the experiments that have been made, the diameter of the pure lead Enfield bullet (Fig. 236), was considerably (0.1 inch) greater than that of the hardened one fired from the Martini-Henry rifle (Fig. 242).   The Mitrailleuse ball (Fig. 243) weighs about 1¾ oz.; the Gatling guns use calibres .45 and .50 small arm ammunition, a " half pound solid elongated projectile," and a one inch

Fig. 239.   Fig. 240.   Fig. 241.   Fig. 242.   Fig. 243.

Austrian ball.   Chassepot (French) ball.   Bavarian ball.   Martini-Henry (English) ball.   Mitrailleuse (French) ball.

canister holding 15 buck-shot; the projected Hotchkiss revolving cannon is to throw shells of a little over one pound weight, and case-shot filled with one ounce balls.

From field guns, the sizes of which vary considerably, shell and case-shot are fired, the use of solid shot having been of late abandoned; the cases containing from 41 to 245 or more balls each, of iron in the English service, of

lead in our own.   From fixed guns and from the larger guns on shipboard, are thrown both solid and hollow shot, the weight of the single-shot and shell missiles employed ranging from seven to two thousand pounds.   If it was true three hundred years ago, as declared by Paré, that a gunshot "going with mighty violence pierces the body like a thunderbolt," how much more so is it now, when a bullet fired from an ordinary Springfield rifle can be driven through 2 inches of pine wood, and from a long-range Springfield rifle through 5 inches of pine at 2500 yards distance; and when a ball from the latter arm is able to pass through 2 inches of pine and penetrate the sand to a depth of 6 inches at a distance of 2 miles (more exactly, 3500 yards).

Effects of Gunshot Wounds upon the Various Tissues.

Before proceeding to the consideration of the results, immediate and secondary, of gunshot wounds, it will be well to notice the general effects which they produce upon the various tissues that may be damaged.

SKIN.—If merely grazed, there will occur either limited erythema with decided pain ("brush-burn"), slight contusion with associated blood-extravasation, or such impairment of vitality as will be followed by the formation of a dry slough.   If more fairly struck, there will be either penetration or contusion, according to the velocity and size of the vulnerating body.   So great is the elasticity of the integument, that it may yield sufficiently to escape laceration, while there will yet take place extensive extravasation of blood, crushing—even pulpification—of the muscles, and comminution of bone.   Such destruction is often produced by large shot, solid or hollow, or a massive fragment of an exploded shell, either passing lightly, but at a high rate of speed, over the surface, or striking only when nearly spent.[1]   Not infrequently it happens that a bullet, striking at an oblique angle, pierces the skin, runs underneath it for a greater or less distance, and passes out again, forming what has been denominated a seton-wound, the track of which is often indicated by a line of discoloration upon the surface.

FASCIÆ.—In the passage of a shot through the superficial fascia, laceration and contusion occur, not confined to the part actually traversed, but extending for a variable and often considerable distance on either side, there being seldom, if ever, when the wound is inflicted by a round ball, any actual removal of tissue, though a conical bullet carries along with it a greater or less amount of that which it has killed.   In piercing the dense external layers of the deep fascia, balls, conical ones particularly, separate somewhat the crossing fibres, so that these fascial openings are of less diameter than the track generally, for which reason they more or less interfere with the subsequent outflow of pus.   If of any considerable size, they oftentimes are not filled up in the progress of repair, but their edges cicatrize, leaving a permanent opening through which in after life muscular bulging readily occurs.   Oftentimes fascial resistance will be sufficient to deflect the shot, the angle of the line of new direction to that previously travelled varying according to the shape and velocity of the ball, being much greater in the

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[1] Macleod, for example, reports that at the Alma, "a round shot 'en ricochet,' struck the scale from an officer's shoulder, and merely grazed his head as it ascended.   Death was instantaneous. The scalp was found to be almost uninjured, but so completely smashed was the skull that its fragments rattled within the scalp as if loose in a bag."   Under my own observation, an extensive shattering of both bones of the leg resulted from the blow of a large piece of shell, which did not break the skin, the case having been sent in from the field as one of contusion simply.

case of the round than in that of the conical bullet, and being greater when the movement of either form of ball is comparatively slow. The heavy pointed rifle-bullet, fired from a modern rifled musket, is unlikely to have its course much altered; while a pistol ball is frequently turned aside; and a round ball has over and again been found to " run around" the half or even whole circumference of the body, its rate of speed being relatively low, and its axial rotation favoring the apparently anomalous course.

MUSCLES.—These, when injured, are always considerably lacerated and contused, and infiltrated with extravasated blood; and, when the damage has been done by a large body, it will generally be found to extend through the whole length of the muscle, particularly so if there has been simple contusion without associated open wound. When the entire belly of the muscle has been broken across, marked separation of the divided parts takes place. However, when a portion of a limb has been carried away, as by a round shot, retraction of the torn muscles does not occur, their contractility having been destroyed by the intense force of the blow. So great is the momentum of the small muscular fragments detached by the conical ball in its passage, that they themselves become actual missiles, and often materially add to the damage resulting from the shot. As might naturally be expected, tendons are much more resistant than the fleshy parts of the muscles. They are often pushed out of the way by the passing ball; and even when they must necessarily feel the force of the blow, as from a large shot, they may be protected by the earlier giving way of the muscular bellies. In a case, for example, reported by Gillette, in which there was a very extensive crushing of all the other soft parts from a wound of the leg and foot, the tendons of the extensors, of the tibialis anticus, and of the flexors were not involved.

BLOODVESSELS.—These, as has long been known, though lying in the direct path of a ball, are not infrequently pushed aside, and escape all injury—arteries, because of their greater thickness and elasticity, being much more likely than are veins to be thus preserved from harm. Very frequently, however, damage is done, and there will be produced either (1) *complete division*, which is almost certain to occur if the wound has been made by small shot at short range, or by the sharp edge of an angular piece of shell, and which is frequently observed in rifle-ball wounds; (2) the *cutting out* of a piece of the vessel wall; (3) *contusion*, followed by temporary or permanent occlusion of the canal, or by sloughing of the bruised vessel and consequent secondary hemorrhage; or (4) the formation of a *traumatic aneurism*, which may be limited to the artery itself, or may be arterio-venous, if both artery and vein have been involved in the injury. It is possible, also, as shown by a case reported by Lidell, that an aneurism may be developed from the extremity of a completely divided artery.

NERVES.—Much less often than bloodvessels are nerves found to have safely glided away from the vulnerating body, their more usually observed injuries being division, complete or partial, contusion, and concussion. Occasionally small foreign bodies (such as splinters of wood or pieces of lead) become lodged in a nerve, causing either little or no inconvenience, or, as is more common, severe and persistent neuralgia. Impairment or entire loss of motion or sensation; pain of varying degree and duration, at times burning (the *causalgia* of Mitchell); trophic changes, or absolute destruction of the vitality of the parts supplied, are the results of these nerve injuries.

Bones.—The violent impact of a ball or piece of shell will produce either contusion or fracture. The fracture is very rarely simple, though such an accident may result from the blow of a piece of wood, or iron, or stone, set in motion by a gunshot projectile which has struck it. It is ordinarily comminuted, frequently extensively so, though there may be (rarely it is true) penetration or perforation without shattering. The contusion may be so slight as to cause little or no damage; so severe as to at once destroy the life of the part struck; or, as generally happens, sufficient to light up destructive inflammation. Penetration and lodgment of the missile may occur; the bullet, if not removed, either becoming encapsulated, or, as is generally the case, causing inflammation and suppuration, and being often, months or years afterwards, found lying loose in an abscess cavity. When it is a long bone that has been pierced, the shot or a part of it may, as in a case reported by Surgeon-general Murray of the British Army, drop down in the medullary cavity, and, by its presence, keep up an osteomyelitis of low grade.

Diagnosis of Gunshot Wounds.

That a gunshot wound has been received, is generally determined by the history of the case and the observation of an abnormal opening or openings upon the surface of the body. Very seldom does it happen, except in attempts at suicide, that the bullet enters by a natural orifice, though it may do so.[1] Ordinarily, the points to be decided are: (1) Whether or not penetration and lodgment have occurred; (2) What course the ball has taken; and (3) Whether the discovered multiple wounds are due to a single shot or to several.

At first sight it would seem to be a very simple matter to determine that a bullet had lodged, a single opening only being found. But it may already have been removed, or it may have rebounded, as happens at times when the skull or other comparatively superficial bone has been struck, owing to the elasticity—not of the lead—but of the osseous tissue; or, what not infrequently happens in cases of spent balls, particularly round ones, it may have been drawn out by the clothing, a part of which, uncut, had been carried like a glove finger over and in front of it. Inspection should always be made, therefore, of the clothing that covered the wounded part.

Much more difficult is it oftentimes to know in what direction the ball has passed, and where it has stopped. The clothing is to be examined, and the position noted of the openings in the various layers, relatively to each other and to the skin wound. The body is to be placed as nearly as possible in the same position as when struck, if this can be determined; a rule of practice as old as the time of Paré. The direction in which the shot was fired, if known, must be taken into consideration. By use of the probe, or better, the finger, the track is to be followed, as far as possible, or until penetration of one of the great cavities is ascertained. A conical bullet, moving at full speed, ordinarily passes straight from the point of entrance to the place of lodgment, if it does not, as it is likely to do, pass through and out; but it is a mistake to declare, as has been done by many, that deflection cannot take place. Fasciæ, and still more bone, will at times turn the bullet aside. Pistol balls are not infrequently thus affected. I have seen, for instance, a case in which the shot, entering the right temple, passed through the anterior lobes

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[1] This was instanced in the case of a distinguished general officer during our late war, who was killed by a shot that passed in through the anus. Gillette reports, on the authority of a M. Boissimon, a hardly credible story of a French officer who was shot in the face, the ball entering through the anterior nares, passing back and striking the posterior pharyngeal walls, and rebounding through the mouth.

of the brain, struck the skull on the left side, and was turned almost at a right angle to its previous course, and lodged in the left posterior lobe. The old-time round ball was very apt to glance and pursue an erratic way, at times making a complete circuit of the body, and emerging through the entrance wound. A spherical shot of considerable size may be turned aside; thus Otis reports a case in which a "one and a quarter inch grape, from a battery about three hundred yards distance, was deflected on striking the hyoid bone, and buried itself in the muscles over the right shoulder-blade."

Even when the direction has been determined and the track followed, it may not be easy to ascertain the location of the ball. It may be masked by a piece of cloth (and nothing but the finger will, as a rule, recognize the presence of such), or it may be a question whether the probe is in contact with ball or bone; a question that of late years has ordinarily been settled by the employment of the "Nélaton probe" (Fig. 244), the unglazed porcelain tip of

Fig. 244.

Nélaton's bullet probe.

which will take a slight bluish stain when rubbed or pressed upon lead. (Having once taken such a stain, however, it is likely to ever after retain it, so that practically a fresh instrument will be required for each new case that is to be examined.) In default of a probe, a clean clay pipestem,[1] or a piece of soft pine may be advantageously used as a searcher. At times it may be practicable to pass in a pair of cutting forceps, and bite off a small piece of the body, examination of which will reveal its metallic or other nature. Various electrical appliances have been used: either probes to be carried along the track of the wound—contact with the metallic foreign body causing the ringing of an attached bell, or deflection of a galvanometer; or needles thrust through the overlying tissues and made to touch the supposed ball, and, by the establishment of a circuit, act on an annunciator or galvanometer; or surface electrodes, which in passing the current through the lead, will cause pain, burning, tingling, and perhaps shock. Thus far the use of electricity in enabling the surgeon to recognize the existence and location of a ball, has been but limited, and, in the main, unsatisfactory in its results. Of such chemical methods as that of Deneux, who suggested the use of a weak acid, either upon an exploring instrument or injected through the track, it may be well said that "though they are ingenious, they are too delicate and too uncertain to be of any great service in Military Surgery." (Rochard.) Where no positive evidence of the location of the projectile can be obtained, either by exploration of the wound or by palpation of the area of the skin towards which it must have passed, its position in a particular part is often rendered very probable by the localized pain which is experienced, by the swelling which, after a few days, is developed, and by the decided interference with the making of certain movements which is recognized.

WOUNDS OF ENTRANCE AND EXIT.

Speaking generally, the entrance wound is smaller than that of exit; but under certain circumstances, and at certain times, the reverse is found to be

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[1] Legouest, ten years ago, reported that he was in the habit of using the clay pipestem, and Heighway employed it during our late war with Mexico, twenty-five years earlier.

true. The differences in this respect that have not infrequently been noticed, and the resulting, conflicting views of observers and writers, may be easily understood and readily explained. It is a well-known law that splintering and tearing are in inverse proportion to momentum, and according as the velocity of a missile is lessened in passing through a portion of the body, will the orifice of outlet present greater size than that of inlet. This diminution of force being much more in the case of a spherical than in that of a conical ball, wounds produced by the former will show correspondingly greater differences in size than those produced by the latter; indeed, oftentimes, a pointed bullet, moving at a high rate of speed, will in its perforation make skin openings that cannot by their size alone be distinguished the one from the other. Again, if the point of entrance is over a surface of bone but a little beneath the skin, as, for instance, on the chin or over a rib, and especially if the shot has been fired at short range, the extent of laceration will be very great; and on the other hand, if the ball in its course shatters a bone just before going out, or carries along with it a quantity of crushed and separated tissue, the amount of skin-tearing will be much in excess of that which otherwise would have occurred.

The size of the primary wound will also be decidedly affected by the obliquity of the angle of entrance, a large degree of which will cause raising of the skin and consequent bevelling of the orifice. After a few days, when separation of the slough has taken place, the entrance wound will usually be as large or larger than that of exit, especially when the injury has been caused by the passage of a round ball. When the shot has been fired at very close range, and has struck an uncovered part of the body, the entrance wound may often be recognized by the powder staining around about it, though such evidence is not as likely to be had at the present time as formerly, since the modern improved powder is so much more thoroughly burned up at the time of its explosion.

MULTIPLE WOUNDS are often met with, and may be due to several shots or to a single one. When to several, these may all have been inflicted at once— as from the bursting of a shell or of a "spherical case," or from volley firing— or they may have been received at different times; and when due to a single shot, they may be consequent upon the repeated passing in and out of the same ball, as in traversing both upper and lower extremities, or the forearm,

Fig. 245.
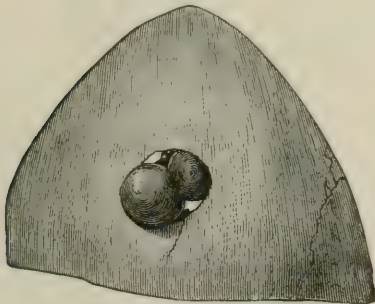
Fig. 246.

Section of frontal bone with split musket ball impacted at left frontal eminence. (A. M. M., Spec. 1293.)
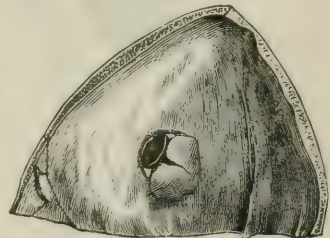
Interior view of frontal bone represented in Fig. 245.

arm, and chest, or may depend upon the splitting of the bullet, either before entering the body, or by contact with a ridge or edge of bone. Not infrequently, the fact that the existing three, four, or more wounds are due to the same shot, can be ascertained only by placing the several parts of the body in

similar position to that held at the time of the injury, and by seeing that
the various openings are then all in line; and even this study of position will
not always answer, for there may have been deflection of the ball at some
point of its course.   That bullets, particularly round ones, are occasionally
split, either in passing into or through the body, every one knows, and such
division may be complete or partial.

In a case under my care, a round musket ball that struck and fractured the frontal
bone was so far split as that one part passed into the opening in the bone, while the
other rested on the external surface, a narrow bridge uniting the halves.   (Figs. 245,
246.)

Conical rifle bullets are much less likely to be thus affected, but abundant
evidence has accumulated to prove the incorrectness of Macleod's belief that
" with their immense force of propulsion they cannot be split." (See Figs.
247, 248.)   Pistol balls, elongated though they are, are every now and then
divided.

Fig. 247.
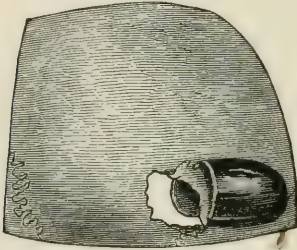
Section of right parietal bone on which a conoidal musket
ball has split.   (A. M. M., Sect. 1, Spec. 2121.)

Fig. 248.
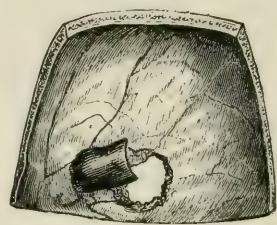
Interior view of parietal bone represented
in Fig. 247.

Quite recently I saw, post mortem, that one of these missiles, after boring through
the head and neck of the humerus, had, in striking the edge of the glenoid cavity,

Fig. 249.
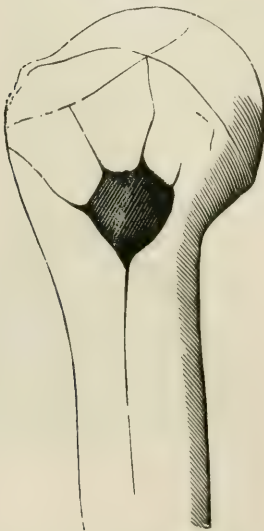
Head and neck of humerus perforated by a pistol
ball which was smoothly cut in two upon striking the
scapula.   (See Fig. 250.)

Fig. 250.
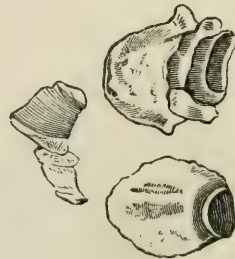
Pistol ball split by striking upon bone.   (See Fig.
249.)

been smoothly cut in two, one half lodging in the supra-spinous and the other in the
infra-spinous fossa (Figs. 249, 250).   Had in this case the propulsive power been a

little greater, these pieces would have been driven out, and there would have been three wounds, one of entrance and two of exit.

Much more rarely than multiple openings from a single shot, has there been noticed a single wound from two projectiles, a condition of things that has been recognized only upon removal of the bullets, or from the persistence of discharge and non-closure of the track after one ball has been extracted.

EFFECTS OF GUNSHOT WOUNDS.

The general effects of gunshot wounds may be classed under two heads, *primary* and *secondary*. The former are consequent upon nervous and vascular disturbances, and are pain, hemorrhage, and shock.

PAIN is exceedingly variable in character and amount, depending upon the shape and velocity of the shot, the part struck, the constitutional susceptibility of the subject, and the special mental condition at the time. Occasionally acute, it is more often dull and tingling, a sensation of contusion as if from the blow of a stick, the degree of the pain, speaking generally, being in inverse ratio to the velocity of the shot. It may not be felt at all: ordinarily because the shot has been received at a time when the individual was under strong excitement, but not necessarily so, as instanced, for example, in the case of wound through both hemispheres of the brain reported by Harvey.

The patient, who was seated in a buggy at the time of the accident, experienced no pain and felt no blow on the reception of the injury, but remarked to a gentleman who occupied the buggy with him, that one of their guns must have gone off prematurely, as he judged from a sensation similar to that produced by the report and concussion of a shot fired near the ear.[1]

When large nerves or nerve cords are divided, there may be immediately experienced a severe pain, lasting ordinarily but a few moments, but in numerous cases little or no suffering is caused.

HEMORRHAGE, too, is very variable in amount, being affected by the size of the vessel, the extent to which this is damaged, and the nature of the vulnerating body. Wounds of the main trunks, if made by large bullets or angular shell-fragments, are very generally followed by immediate and fatal bleeding. To such we are undoubtedly justified in attributing many of the deaths in action, though it is impossible to estimate the proportion of mortality due to this cause with any degree of accuracy, owing to the small number of battle-field examinations that have been made. The French reports from the Crimea place it at 18 per cent., a figure certainly none too high. Lidell has shown that hemorrhage was evidently the cause of death of nearly one-half of the forty-three soldiers whose bodies he examined after an engagement in front of Petersburg; and that of the remaining half, most were shot in the head.

But while they are of the gravest character, these wounds of the great vessels are not necessarily at once mortal. The aorta itself has been penetrated by a round ball, and life preserved for days and even for weeks. During our late war, cases were treated in hospital in which the vertebral, carotid, subclavian, axillary, and common iliac arteries, and internal jugular, internal iliac, and femoral veins were divided, as was proven by post-mortem exami-

[1] Asst. Surg. P. F. Harvey, U. S. A., in American Journal of the Medical Sciences, July, 1879.

nation. I have myself seen a patient live for ten hours after a pistol ball had passed through the superficial femoral and profunda arteries and the femoral vein; and another in whom death did not occur until the eleventh day, though the pistol ball had cut the left subclavian. Ordinarily, the primary hemorrhage, aside from the first gush, which may or may not be considerable, is but slight, so much so that it has often, though incorrectly, been declared that "gunshot wounds do not bleed." The explanation of this is, of course, to be found in the contused character of the wound of the vessel—contraction, retraction, curling up of the divided inner coats, and coagulation, all combining to close up the orifice. At a later period in the progress of these cases, secondary hemorrhage is very likely to occur, and is often followed by a fatal issue.

SHOCK.—This nervous disturbance, of the intimate nature of which little or nothing is known, but which for the present may be assumed to concern chiefly the ganglionic system, is in some degree or other an almost constant accompaniment of gunshot wounds. This "reflex effect of the injury of nerves, large or small" (Mitchell), is indicated by enfeeblement of the heart's action, and occasionally disturbance of its rhythm; by resulting pallor, especially of the face, with clamminess of the skin, and at times decided and great reduction of temperature; by nausea and vomiting; by relaxation of the sphincters; by mental irritability, amounting it may be to delirium; and by more or less complete loss of consciousness. These reflex phenomena are very often markedly aggravated by the effect of fright on the one hand, and of hemorrhage on the other, so much so that in a given case it may be difficult, indeed impossible, to properly apportion the observed symptoms to these simultaneously acting causes. The nearer the wound is to the three great centres—those of intellection, of circulation, and of digestion—the greater, other things being equal, is the degree of shock produced, the greatest being, as a rule, noticed when the intra-peritoneal viscera are damaged, as might naturally be expected from the intimate nervous connection which these all possess with the semilunar ganglion, "the abdominal brain." From the earliest times, surgeons have laid it down as a law that severity of shock is proportionate to, and consequently indicative of, the gravity of the injury; and this is undoubtedly true, though the original constitution of the individual and his special mental state at the time of the wound (as regards fear, excitement, drunkenness, etc.) exercise a great influence upon the degree of development of this condition. In a diagnostic point of view, the most important symptom of shock is reduction of temperature.

Redard, as the result of careful observation of fifty cases in Paris, declares that " In gunshot wounds, a fall of temperature is a constant phenomenon. . . . Every wounded man brought to field hospital presenting a temperature lower than 35.5° C. (about 96° F.) will succumb, and consequently it is useless in such cases to resort to any operation. Every wounded man in whom a salutary reaction does not come on by the end of the fourth hour, and in whom the reaction is not in direct proportion to the fall [of temperature previously], ought to be considered as in a very serious state. Penetrating wounds of the abdomen produce an exceptionally low fall of temperature, which is more marked as the stomach is approached. . . . Wounds by shell, other things being equal, produce a more marked fall of temperature than those by ball."

SECONDARY EFFECTS.—*The secondary effects* are those of *inflammation*, the degree of which will be very materially affected by the condition of the subject, the location of the wound, the size of the shot, and the treatment employed. Although at times flesh wounds, especially those made by single bird-shot and small pistol balls, are quickly recovered from, and the healing

is accompanied with very little local disturbance—so little that practically the repair is by first intention—yet, in the great majority of cases, gunshot wounds follow the ordinary course of lacerated and contused injuries. The devitalized tissue along the track is thrown off, suppuration occurs, granulations are developed, adhesions take place, and the external wounds in due time cicatrize. The inflammation which attends the reparative process is early set up, frequently within a few hours—six or eight—almost certainly within twenty-four, and in simple cases presents nothing peculiar. In the severer injuries, as those in which a bone is damaged, both the local and constitutional symptoms are much graver, and there is a strong probability of the development of one or more of the several complications to which reference will presently be made. In proportion as the patient is in good health, receives prompt attention, and is kept quiet, is the probability of but a moderate degree of inflammation resulting; and, on the other hand, when, as is so often the case in time of war, the constitution is already enfeebled by excesses, over-work, or disease—the wound is for hours, perhaps days, neglected—and the patient has been jolted for miles over rough roads—even the simplest of flesh wounds may be attended by local and general disturbances of high grade.

COMPLICATIONS OF GUNSHOT WOUNDS.

Of much greater importance, because of their much greater danger to life, are the not necessary, but frequently occurring, complications of inflammation and results of wounds: secondary hemorrhage, septicæmia and pyæmia, gangrene, erysipelas, and tetanus.

SECONDARY HEMORRHAGE.—Though, as we have already seen, severe primary bleeding is of comparatively infrequent occurrence in the cases of gunshot wound coming under treatment, a later hemorrhage very often takes place, and contributes largely to the fatality of such injuries. This bleeding may come on within a few hours after reaction has been established (when it is simply "delayed," and not properly "secondary"), or, which is much more common, after the expiration of several days or even weeks; complete certainty of its non-occurrence being only secured by the entire healing of the wound. In the great majority of cases, secondary hemorrhage depends either upon the separation of an originally contused portion of the vessel-wall, or upon the melting down of an artery and of its plugging coagulum, in the midst of an inflamed and suppurating area. In the former case, it is most likely to come on during the second week, and probably the first half of it; and in the latter, somewhat later, quite generally from the fifteenth to the twenty-first day. The first hemorrhage is usually very profuse, when the artery is opened by the detachment of a slough, and may be so when due to ulceration, though frequently in such a case it is primarily but slight, but soon recurs in larger and perhaps fatal amount.

The blood may almost wholly escape externally, or may be chiefly poured out into the surrounding tissues; or there may be both extensive infiltration and large discharge from the wound. The accident may come on without any special exciting cause; or may be due to injudicious movements—as, for instance, of a limb in which a sharp edge of bone has been for days fretting away the arterial coats, or in which a bone fragment is thrust against an already softened vessel—or of the whole body, as when the patient makes an unwonted exertion, as in jumping out of bed; may result from sudden disturbance of the circulation from mental excitement, as from anger; or, which

is a very frequent cause, may follow upon violent straining, as at stool. Cachectic conditions, especially scurvy and chronic diarrhœa, and the very much more rarely met with peculiar constitutional predisposition of "bleeders," render the occurrence of hemorrhage after the receipt of a wound much more likely. However produced, secondary hemorrhage may quickly end the life of the patient, as it is very apt to do if the artery is above medium calibre; or recurring again and again, by the resulting prostration and mental depression, it may more slowly, but none the less surely, bring about a fatal result.

Septicæmia and Pyæmia.—To "blood-poisoning," especially in military practice, is due in [a great measure the mortality of gunshot wounds not necessarily and speedily fatal. Consequent, probably, upon the absorption of an organic, septic material, developed in the injured tissues, it may manifest itself by phenomena due to the circulation of blood unfit for nutrition, the nervous system being thereby profoundly impressed (*septicæmia*); or by the formation of visceral metastatic abscesses, chiefly in the lungs and liver (*pyæmia*). Occasionally both conditions exist together. The poison, whatever it may be, is ordinarily formed in connection with an open wound, either produced by the shot or by subsequent operation; but is at times generated in the damaged tissues of a contusion. The lymphatics are its chief primary carriers in the septicæmic cases, the veins in the pyæmic. In the former, the symptoms are ordinarily developed at an early period, sometimes within the first thirty-six hours; in the latter, they do not appear until after suppuration has been established. Diffused metastatic inflammations, with resulting suppurations, are met with in both forms of blood-poisoning, but more commonly in the pyæmic; and such inflammations attack by preference the larger joints and the superficial fascia, and occasionally the viscera and glands. The circumscribed, multiple abscesses of the lungs, liver, spleen, kidneys, or brain, are due to embolic infarctions, the emboli being not simple, but septic, and the poisonous impress having been made upon them while they were still component parts of the primary venous thrombus.

Whether or not external aërial organisms are the exciting causes of the poison-generating changes that take place upon and in the immediate vicinity of an open wound, is still a question. That the poison once generated can be transferred from one wounded man to another by sponges, by dressings, by attendants, or by currents of air, admits of no doubt. Nor can it be denied that everything that tends to lower the general tone of the system renders an individual more likely to suffer from septic disease. Malarial affections, scurvy, forced marches, insufficient and improper food, excesses, the depression of defeat, captivity, with its frequently associated overcrowding—each and all have contributed much to the predisposing of wounded soldiers to outbreaks of this bane of military surgery, that at times becomes, as it was in the late siege of Paris, a "hideous scourge."

Symptoms of Pyæmia and Septicæmia.—Though these two affections have in their symptoms much in common, yet they present sufficient differences to permit ordinarily the ready establishment of a differential diagnosis. Both are marked by rapidly developed high *fever*, with great, irregular, and quickly recurring (almost always daily) variations of temperature, the thermometer indicating a body-heat at one time as low as normal, at another as high as 104°, or 106°, or even 107° F.—higher as a rule in septicæmia than in pyæmia. The *pulse* is feeble, and generally rapid, though there is not of necessity the ordinarily observed relationship between pulse-rate and temperature. Profuse *sweatings* occur, especially in pyæmia; *diarrhœa* is often present; and the *breath* acquires a peculiar and characteristic odor. Little or no *pain* is

experienced; *mental hebetude* is generally well marked; a low muttering *delirium* is very frequently present, and, much more rarely, an active maniacal state. As we have already seen, septicæmia may set in at any time, pyæmia only after suppuration has occurred.

Septicæmia is very seldom ushered in with a *chill*, and, when it is, never has more than the initial one; pyæmia always commences with a chill, and subsequent rigors, occurring at irregular intervals, are very rarely absent. The *skin* in septicæmia is pale and sometimes muddy; in pyæmia it is jaundiced, often deeply so, though the discoloration may be noticed chiefly, perhaps only, in the conjunctiva. In septicæmia, *visceral inflammations* are not commonly present; in pyæmia, pleurisy and pneumonia, or hepatitis, are lighted up around the abscesses, though frequently these occasion comparatively little distress. A septicæmic *parotitis* has not infrequently been observed, and in most instances in which it has been seen, the case has terminated fatally. The pyæmic *joint suppurations*, and abscesses in the superficial fasciæ, are very rapidly developed, and frequently give rise to no subjective symptoms whatever. The attending *wound*, if suppuration has become established, usually becomes dry, the granulations are pale and withered, and what pus there is, is often fetid, though at times little or no change in appearance or secretion is observed.

Prognosis.—The fatality of acute blood-poisoning is extreme; and every one who has seen much of it will be almost if not altogether ready to declare, with Mr. Longmore, that it is doubtful whether in military surgery it is ever, when thoroughly manifested, "checked in its deadly advance." In civil life, recoveries occasionally take place. Death may, particularly in septicæmia, occur within twenty-four hours, but usually the patient lives from four days to a week. Subacute and chronic cases much more often terminate favorably, though even in these the percentage of deaths is high, especially in the chronic variety, in which very often, after weeks of little or no apparent change in the symptoms, as indicated by pulse and temperature, the patient finally succumbs to the slowly but surely progressing prostration.

GANGRENE.—Consequent upon, or at least associated with, gunshot wounds, both *traumatic* and *hospital gangrene* are met with; the former frequently, the latter rarely, and then, usually, occurring as a local epidemic.

Traumatic Gangrene.—The ordinary traumatic gangrene of military surgery is of the moist variety, and may depend upon one or other of several causes. Very occasionally, the death of a part is immediate upon the receipt of the blow—for it is usually due to contusion by large shot—both bloodvessels and nerves being functionally, if not actually, destroyed at once. The color of the skin is at first unchanged, or whiter than normal; arterial pulsations are absent, and the local temperature is much and rapidly lowered. Again, after the receipt of a bullet wound, apparently of no special severity, pain may, in the course of a few hours, be experienced in the injured part, followed by rapidly forming great swelling, lividity of the skin, and gaseous distension, with constitutional symptoms of high grade—an intense typhoid condition being often developed before death, which takes place generally within twenty-four hours.[1] The development of such "*gangrène foudroyante*," asso-

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[1] As an example of speedy death, may be cited Gillette's case, in which, on the fourth day after the receipt of a shell wound of the forearm, "in the morning, the whole left upper extremity, from the hand to the clavicle, was found to be extremely swollen, the skin as tense as a drumhead, presenting in places a violet-blue discoloration with blebs. Emphysematous crackling could be felt all over the limb. In spite of numerous incisions, the patient died in the middle of the day."

ciated with open wound, has of late been generally attributed to the influence of septic bacteria, but by Wyatt (who saw it in Paris during the siege) it is declared, though incorrectly, to be confined to the lower extremity, and to always indicate division of the sciatic nerve.

The great majority of cases of gangrene are consequent upon interference with either the inflow or outflow of blood in the wounded part, or below it; and such interference with the circulation may be caused by inflammation, by blood infiltration, by the plugging or ligation of the main vessels, or, occasionally, by the constriction of badly applied dressings. In inflammation, there is both stasis in the vessels of the affected area, and pressure exerted by the effusion and exudation upon the arteries and veins of the adjacent parts; in the hemorrhagic infiltrations, there is like pressure exerted by the extravasated blood, which may be in a single mass of considerable size, from tearing of a large vessel or vessels, or in many small collections from the general laceration that is always found extending some distance on either side of the wound. Very generally these two causes, in varying relative proportion, are found acting together.

The gangrene thus produced presents the ordinary symptoms which characterize it when resulting from traumatisms other than gunshot, the pain, the after insensibility, the coldness, the color changes, and the tendency (stronger or weaker, according to the extent of the damage and the general condition of the patient) to the formation of a line of demarcation and spontaneous separation of the dead tissue. When the chief artery or vein, or both, of a limb have been contused, their closure is very apt to occur, either from the pressure of blood from the ruptured vasa vasorum, extravasated between the sheath and the vessel, or, much more probably, from the formation of a thrombus; sometimes, perhaps, from inflammatory stenosis. The resulting mortification begins at a distance, and usually, if left to itself, advances steadily and rapidly up the limb, with not even an attempt at the establishment of a line of demarcation, and speedily causes death. In such a case, following a wound from side to side through the popliteal space, I saw the whole limb become gangrenous, and the patient die in less than thirty-six hours after the first symptoms manifested themselves in the foot. When the cause is not plugging, but ligation of the main artery, though there may be a similar uninterrupted extension of the mortification, spontaneous arrestation not infrequently occurs; just below the knee, for example, when the femoral or popliteal is the trunk that has been tied, the vitality of the parts above being maintained by the blood carried through the profunda.

The fatal result in these cases of gangrene is usually due to blood-poisoning—either septicæmic, from absorption of the fluids from the dead and dying parts, or pyæmic, from the formation of thrombi and their subsequent destruction—though when death occurs suddenly, as it does at times, it may be, as maintained by Parise, because of the entrance into the heart of the gases of decomposition, which produce results the same as those that follow the admission of atmospheric air through veins divided in an operation.

Hospital Gangrene.—This, unlike ordinary gangrene, is not an effect—a death in mass from injury of nerves, or more generally of vessels—but is a disease which manifests its presence by tissue destruction of greater or less extent. Occasionally occurring sporadically, and in private practice, in the great majority of cases it is met with in hospitals, where large numbers of wounded are aggregated. Any wound, even the smallest, may suffice for its starting point, but it does not commence on an unbroken surface; shell wounds are said to be particularly likely to be attacked by it. Regarded by some as

primarily a constitutional affection, it is believed by most to be of local origin, the general symptoms occurring only secondarily, and sometimes being absent altogether. Attacking more often those broken down by dissipation, overwork and over-worry, scurvy, diarrhœa, or malaria, it yet may seize upon the strongest and the healthiest. It cannot depend upon weather or place, since it has prevailed at all seasons and under the most diverse climatic and atmospheric conditions. Many of the Germans have seen in it but a wound diphtheria; but by surgeons generally the two diseases are regarded as separate both as regards etiology and symptoms, though both are characterized by the deposit of fibrinous infiltration on the affected tissues. Believed by some to depend upon the presence of a special organism, none of the more competent observers have been able to discover in its discharges anything else than the ordinary bacteria of putrefaction. Heine's statement is still a true one, that its cause is "a specific poison of unknown nature, which exerts its action upon the surface of the wound and produces a coagulation of the fluids, passing step by step through the superficial to the deeper parts."

That hospital gangrene is both contagious and infectious, is certain, and when prevailing epidemically, its direct transmission from patient to patient may generally be easily shown. Three varieties are met with—the ulcerative, the pulpy, and the gangrenous—the two latter being very often, if not generally, associated.

The *ulcerative* is the rarer and the milder form; the others are more common, and are always attended by general disturbances, often of great intensity. Locally, the ulcerative form shows " a small cup-shaped excavation, with raised edges of a deeper color than the rest of the wound, filled with a brownish tenacious ichor. Many of these ulcers may be simultaneously developed on the same wound; extending superficially and in depth, they destroy the granulations, and give rise to an abundant secretion of an ichorous fluid. The fusion of a number of ulcers accelerates the progress of the disease that soon affects the entire wound, the suppuration of which is arrested, and in place of the pus, there is poured out a fetid liquid, colored dark by blood." (Legouest.)

In the *pulpy* variety, which may be the primary form, or may be consecutive to the ulcerative, there are developed "false membranes, firmly adherent, covering a part or the whole of the wound. This semi-concrete material of a dirty grayish-white color, with blackish points as it were sprinkled over it, exactly covers the invaded parts; it steadily and rapidly increases in thickness and consistence, then softens down, and becomes converted into a violet-gray putrilage, horribly fetid, that partially or completely falls off, leaving underneath sometimes an ulcerated surface, sometimes a layer of material that afterwards goes through the same changes." (Legouest.)

The *gangrenous* variety attacks usually " recent wounds and stumps. The whole injured surface is covered with a layer of material that presents the appearance of moist gangrene, in which are found numerous particles of dead cellular tissue, with disseminated small blood clots of grayish, brown, or greenish color, and from which there exudes a grayish and very fetid fluid. The gangrenous layer is thrown off in mass, or in pieces of some size, on the third or fourth day; dead masses, made up chiefly of the connective tissue, are drawn out in pieces of greater or less size from the muscular interspaces and the subcutaneous layers. The skin over the affected part is of a wine-lees redness, thinned at certain points, and softened at others where fluctuation is present. The detachment of the sloughs sometimes exposes a new pseudo-membranous layer; more often it leaves uncovered the tissues, which show themselves of a pale rose color, and which secrete a sero-purulent liquid of bad odor." (Legouest.)

Hemorrhage not infrequently occurs in hospital gangrene, especially when the exudations are colloid in character, and if of considerable amount, the bleeding forms so important a feature of the case that some writers have described a special variety of the disease—the *hemorrhagic*.

Hospital gangrene has an incubative stage of uncertain length, shorter in proportion to the after-severity of the attack. During this stage the wound ordinarily becomes dry, and the granulations perhaps œdematous, perhaps very vascular and irritable. Pain is always present from the start, and is usually a very important symptom, becoming not infrequently excruciating. High fever of typhoid character attends the severer and more acute cases. The temperature of the affected part is often but little elevated. The extent of the local destruction varies with the character of the attack, the condition of the patient, and the nature and thoroughness of the treatment. The connective tissues and the muscles rapidly melt down, while the tendons and ligaments resist for a considerable time. The larger nerves and blood-vessels do not readily yield, and have not infrequently been observed for days bridging over a chasm made by the destruction of muscles and fasciæ; and oftentimes they escape altogether. In the worst cases, even the cartilages and bones are eaten up, and Ollivier reports that he has seen a whole extremity destroyed within 48 hours. The milder attacks may spontaneously terminate in recovery, but usually a favorable result is secured only by proper treatment. The severer cases judiciously cared for are ordinarily cured in fair proportion, though in certain epidemics the mortality has been enormous, as high even as 80 per cent. Death, when it occurs, may be due to erysipelas (which has been known to attack one-third of the cases), to hemorrhage, to pyæmia, or to septicæmia.

Not so very seldom, the disease has been seen affecting one wound on a patient's body, while another on the same person remained unattacked. Thus Thomson has reported a case of simultaneous wound of both thighs, in which, "whilst the gangrene was ravaging the left thigh, the rapid cicatrization of the right proceeded uninterruptedly." How is such a condition of things reconcilable with the theory of a constitutional origin of the disease?

ERYSIPELAS.—This affection is frequently seen associated with gunshot as with other wounds, occurring both in the simple and in the phlegmonous variety, and presenting its ordinary phenomena. The simple *cutaneous* form of the disease may appear early, but is often not developed until the healing of the wound is well advanced. When occurring in comparatively healthy subjects, it adds but little to the gravity of the case, merely, as a rule, delaying recovery.

Phlegmonous Erysipelas (which oftentimes affects primarily the subcutaneous connective tissue, and only secondarily involves the skin) is, on the other hand, a very serious complication, causing extensive destruction of tissue, and being, in a considerable proportion of cases, followed by death from exhaustion, or, more often, from blood-poisoning. Consequent upon either the influence of outside organisms or septic material developed in the dead and dying tissues of the wound, phlegmonous erysipelas is commonly a hospital affection, highly contagious and infectious, which may attack its subject early or late after the receipt of the injury. More likely of course to seize upon the weak and debilitated, its victims are often among the strongest and healthiest.

TETANUS.—This most fatal of all the complications of gunshot injuries is, fortunately, of comparatively rare occurrence. Its cause is unknown. Usually regarded as consequent upon nerve injury, its symptoms being developed either

by reflex irritation or by induced pathological changes in the spinal cord, it is believed by many to be the result of a peculiar form of blood-poisoning, and by others is thought to be due simply to atmospheric conditions. Tetanus is very seldom met with in connection with wounds of large nerve trunks, but is generally associated with lacerations of the peripheral filaments, especially in regions in which the Pacinian corpuscles are most abundant. It may manifest itself at any season of the year, but more frequently when there is a marked difference of temperature between midday and midnight,[1] or when cold, wet weather follows a warm, dry spell. Prolonged high heat, as in tropical climates, unquestionably predisposes to tetanus, or at least favors its development. It seems to be of rarer occurrence among the wounded of modern wars than it was formerly, because, as may be properly assumed, gunshot injuries are now less irritated, and are better cared for than in previous times. Usually acute, and almost certainly fatal, it may be of milder character, of more prolonged duration, and of proportionately less mortality. Its action may be confined to a few muscles, those of the jaw being usually affected (*trismus*), or may be more widely exerted, producing in the great majority of cases a backward bending of the body (*opisthotonos*). Larrey's opinion that the direction of the arching depended upon the location of the wound—on the back, front, or side—is believed by few, if any, of the surgeons of the present day to be correct. Death usually occurs within a few days; in half or more of the whole number of cases, within the first five.

PROGNOSIS OF GUNSHOT WOUNDS.

This must, of course, depend upon the nature and location of the wound; upon the treatment adopted, and upon whether it is instituted promptly or not; upon the hygienic surroundings of the patient; and upon his general condition before and at the time of the reception of the injury. Other things being equal, the patient's chances of recovery are better in civil than in military life, for, as Sir W. MacCormac has very truly said, the danger of gunshot wounds "often arises more from external circumstances—overcrowding, want of after-care, long transport—than from the nature of the injury itself." Taking large numbers of wounded together, the mortality of cases coming under treatment is from 10 to 15 per cent.; but such a statistical statement is of little or no value, since the probability of recovery in any given case depends upon its particular circumstances.

TREATMENT OF GUNSHOT WOUNDS.

This consists in clearing the wound from foreign bodies; combating, as far as may be, the primary effects (pain, shock, hemorrhage); moderating the resulting inflammation; and meeting such secondary complications as may arise.

REMOVAL OF FOREIGN BODIES.—From the earliest times, "immediate exploration" has been the rule, to the end that any foreign bodies which have

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[1] In his account of the Austrian campaign of 1809, Larrey wrote : "The wounded who were most exposed to the cold, damp air of the chilly, spring nights, after having been subjected to the quite considerable heat of the days, were almost all attacked with tetanus, which prevailed only at the time when the Reaumur thermometer varied almost constantly between the day and the night by the half of its rise and fall ; so that we would have it in the day at 19°, 20°, 21°, and 23° above zero (75° to 84° F.), while the mercury would fall to 13°, 12°, 10°, 9°, and 8° during the night (50° to 61° F.). I had noticed the same thing in Egypt."

lodged, may be detected and removed; these being either the missile itself (small shot, bullet, or shell-fragment), which has not passed through and out, or other substances carried in with the ball, such as coins, keys, fragments of watches, etc., and especially punched-out pieces of clothing.[1]

Bird-shot, fired from a distance, and small pistol bullets, are very likely to lodge, often being much flattened, generally from striking upon bone. Angular pieces of shell, if projected edgeways, are almost certain to lodge, even when of large size; cloth, when carried along with a bullet, though occasionally adhering as a cap or even complete covering, is generally left somewhere in the track, whether the wound is penetrating or perforating, and under such circumstances, if not removed, remains as a constant source of irritation, with resulting sinus and attendant discharge, due, according to Neudörfer, to the organic nature of the material. The sooner the exploration is made the better; since the search is less painful at first than it becomes subsequently, and since the track of the ball is then more open, and therefore more readily followed. After the inflammatory stage has set in, the wound should be left undisturbed until suppuration is well established, any interference with it at this time being likely to increase the existing irritation. The most serious results, even in some cases the development of tetanus, have been produced by such inopportune exploration.

For the discovery of foreign bodies, the finger is by far the best of all instruments, and it should always be employed when the size and length of the track will permit. In other cases, the probe must be used, either the ordinary probe of the pocket-case, or a much longer one (which, however,

Fig. 251.
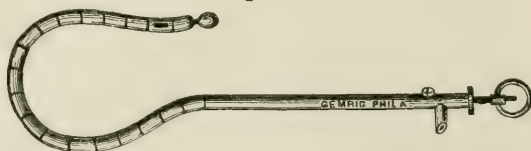
Vertebrated probe (Sayre).

may easily be made in two or more segments, and thus readily carried), or a vertebrated, or better, spiral probe, which, by its flexibity, will more readily follow the course of the ball. But of the use of any of these probes, it may still be said, in the words of Paré: "Oftentimes you shall scarce by this means find the bullet," and only by lucky chance a piece of cloth, the presence of which can, as a rule, be recognized only by the finger.

Are all wounds to be explored? In civil practice I believe not, or at least not to any great extent. Very frequently the injury has been inflicted by scattered bird-shot, or by a pistol ball of small calibre. In the former case, if the lead does not lie near enough to the surface to be felt upon palpation, much less damage is likely to result from its presence than from attempts to find it. In the latter, if judicious and not long continued probing fails to reveal the location of the little bullet, it may safely be left, either to become encysted or to be loosened and brought to the surface in the process of suppuration. When the wound has been made by a musket ball, or by a pistol ball of large size, the case is altogether different. Here an exploration should always be made, so that it may be known what damage has been done, and so that the

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[1] The sizes and kinds of foreign bodies that may be lodged, sometimes unknown to the patient and unsuspected by the surgeon, almost surpass belief: a round shot of 32 lbs'. weight "buried itself under the skin and muscles of the hip" (Hennen); one of 12 lbs. in the thigh (H. W. Davis); one of 8 lbs. in the thigh (Guthrie); one of 6 lbs. under the scapula (Chenu); one of 5 lbs. in the thigh (Larrey)—the four last mentioned having been discovered only upon amputation.

nature and location of the foreign body may be determined. But a penetrating wound of either of the three great cavities, no matter how made, is to be explored only so far as to prove that the bullet has passed through the wall. Though by judicious probing, as we shall see hereafter, it may be possible to ascertain the location of a missile, and thus determine the feasibility of an attempt at removal; yet the most experienced surgeon may easily and unknowingly produce visceral injury in a fruitless effort to trace the course of a shot, and the safest rule for general adoption is that just given. Not so very seldom in pistol wounds, the surgeon and his probe together do more harm than the bullet.

The existence and position of the foreign body having been ascertained, it should be removed, if this can be done without too much risk. For this purpose the finger or forceps, one or both, will usually be employed. Bullet forceps of many patterns have been used from time to time, the best at the present day having rather slender but very firm jaws, with or without slightly projecting teeth that will take a secure hold of the ball. (Fig. 252.) The Coxeter forceps (Fig. 253) has long been a favorite with English surgeons,

Fig. 252.
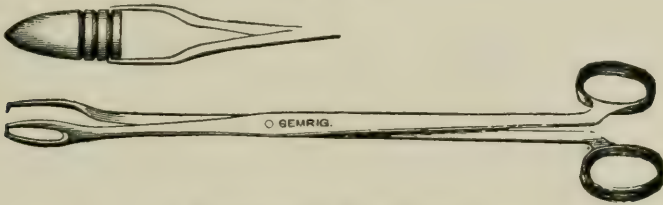
Bullet forceps (U. S. Army pattern).

but there lies against it the serious objection that it is often very difficult to carry its scoop under and beyond the shot. For the extraction of small pistol

Fig. 253.

Coxeter's bullet extractor.

bullets, or bird-shot, the common dressing forceps answers very well. When the ball is fixed in a bone, or wedged between two bones, an elevator may often be employed to advantage, or a sequestrum forceps, or some one of the many forms of *tirefond* or screw instrument. The bullet can often be removed much more easily through a counter-opening than through the original wound, care being taken to thoroughly fix the foreign body, and to divide all of its coverings by an incision that shall at least equal in length the diameter of the shot. Not infrequently it happens that the extraction of the foreign body is no easy matter; it should never be roughly jerked away, but the track should be enlarged with the knife if necessary.

Much has been written and said about the proper way of grasping the missile, but " the truth is that, on most occasions, one seizes the projectile or the foreign body as he can; the important thing is to seize it firmly, so that it may not escape from the jaws of the forceps during the extraction." As respects pieces of bone, the rule is to remove only those fragments that are entirely detached, leaving the others either to be thrown off at a later period, or

to be incorporated in the reparative callus; the extraction of loose fragments (the primary sequestra of Dupuytren) should be effected as soon as possible, in order to prevent or moderate the irritation that almost always results from their presence—almost always, but not always, for once in a while spicula will be found, long after the receipt of the wound, resting quietly in the midst of perfectly healthy tissue.

TREATMENT OF PRIMARY EFFECTS: HEMORRHAGE.—The immediate effects of the wound, *pain* and *shock*, are to be treated in the ordinary way. What shall be done for the arrestation of *hemorrhage*, is, perhaps, the most important question that can be asked respecting the treatment of gunshot wounds. *Primary bleeding*, as we have already seen, may and often does spontaneously cease. *Secondary hemorrhage*, too, may stop without surgical interference, but comparatively rarely. To control bleeding, resort may be had to compression, to the use of styptics, to the employment of the actual cautery, or to the application of the ligature.

Compression, when it can be properly effected; when there has been a complete division of the vessel, and that not a large one; when there is underneath the artery a firm bony surface, affording counter-pressure; or when the bleeding is venous, oftentimes answers an excellent purpose. When applied, not over the seat of injury, but above, upon the main vessel, or completely around the limb, it is of great temporary value, and may for the time being be the only practicable method of checking the flow of blood; but in military surgery it is well known to be a dangerous measure, being very apt to be too tightly or too long applied, when it produces great swelling of the parts below, if not their actual death. By pressing with the finger in the wound, directly upon the bleeding point, the outflow of blood can be perfectly prevented until time and opportunity have been afforded for the application of a ligature; and it should always be borne in mind that very little direct force is required to stop the circulation through even a large artery.[1]

Delayed hemorrhage after amputations, if not in large amount, may often be readily and perfectly arrested by methodical compression with a bandage, thus obviating the necessity of reopening the stump.

Styptics should not, as a rule, be employed for the checking of bleeding, other than that from very small vessels (when pressure or torsion will generally answer better), or from the general surface of the wound—capillary or parenchymatous hemorrhage, which is very often but the precursor of an attack of pyæmia—or when it is from an artery which is deeply seated and difficult to find and take up. Even in the latter case, the use of the persulphate or of the perchloride of iron, which are the styptics ordinarily employed of late, very often fails of accomplishing the desired object, and only serves to waste valuable time, and to put the patient, because of recurrent hemorrhage, in a much worse condition than he was at first. So much abused and improperly employed are these per-salts of iron, that it would certainly be better for the subjects of gunshot wounds if these agents were banished from the surgical pharmacopœia.

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[1] As illustrative of the good effect of digital pressure, and of an exceptionally favorable result of compression, may be cited Larrey's case of wound of the external carotid. The ball cut the vessel at its point of separation from the internal carotid, and as it entered the parotid gland. "The fall of the wounded man and the considerable spurt of blood that came through both openings, attracted the attention of the cannoneers. One of them, a very intelligent man, had the presence of mind to promptly thrust his fingers into the openings, and thus stop the bleeding. . . . A methodical compressive bandage, to my great astonishment, arrested the rapid march of death, and saved the officer."

Actual Cautery.—The hot iron has often been very advantageously applied to bleeding surfaces, but its use is always attended with risk of recurrence of the hemorrhage upon the detachment of the slough which it produces.

Ligature.—By far the surest and best hæmostatic is the *ligature*, which should be applied, whenever possible, to the wounded vessel just above and below the point of injury. When placed at a distance, on the proximal side, it may control the bleeding; but very often with the establishment of the collateral circulation, the hemorrhage will begin again, and there will then have been added to the original wound one higher up, and with it a new danger from premature separation of the ligature. Dupuytren's opinion that tying the artery in the midst of inflamed and suppurating tissue would probably result in too early cutting through of the thread, and consequent bleeding, has over and again been proved to have been an erroneous one, and surgeons to-day are almost unanimous in declaring that a wounded and bleeding external artery should be sought for and tied in the wound. It may be found that the blood is issuing from a vessel of but small size, and at times, when the shot track is opened up, the source of the hemorrhage may not be discovered; but the bleeding will nevertheless probably stop not to begin again.

In a musket-ball wound of the popliteal space, secondary hemorrhage came on in such amount as to make it probable that it was from the popliteal artery; yet, when the track of the wound was laid open, I could not find the injured vessel. There was no bleeding afterwards.

Abundant cases are on record, in which ligations of important trunks have been practised—sometimes with resulting death—and in which the hemorrhage has subsequently been ascertained to have arisen from easily found vessels that might and should have been tied.

Shall an artery that has bled, but is not actually bleeding, be ligated? Guthrie said No; but for want of ligation in such a case, when the bleeding has been secondary, many a life has been lost. Though it may not be necessary, it is certainly safer, when the hemorrhage is known to have come from a large vessel, to expose this and tie it; and this should be the rule in all cases other than those of primary bleeding. In these, no operative interference should be adopted until recurrence of the hemorrhage has proved that it is required.

Venous Wounds should be treated on the same principle as those of arteries. Properly applied compression is more likely to produce a favorable result in these than in arterial wounds, and should, as a rule, be the method employed. When, however, a large venous trunk has been wounded, it should be tied. If the opening in the vein involves but a small part of the circumference of the vessel, lateral ligation, as recommended by Travers, may be adopted, but it is very apt to be followed by secondary bleeding. In all cases of wounds of the main venous trunks, there is much danger of resulting death, from gangrene, recurrent hemorrhage, or pyæmia. Langenbeck has advised that in this class of injuries, both the main artery and the vein should be simultaneously ligated, or the artery alone tied, declaring that when double ligation is practised, gangrene of the parts beyond "could only occur if extensive thrombosis of both trunks should prevent the establishment of the collateral circulation;" and believing that "ligation of the wounded vein will without doubt prove unnecessary, and should, as a rule, be avoided, on account of the danger of thrombosis." In such treatment of both the artery and the vein, or simply of the artery, he thinks we have a "sure remedy to control venous hemorrhages that have heretofore been considered absolutely fatal." Whether

or not future experience will establish arterial ligation as the proper mode of practice, is a question. According to Wyeth, of nine cases of simultaneous ligation of both the common carotid artery and internal jugular vein for injuries of various kinds, seven ended in death, and only two terminated in recovery.

In all cases in which ligation is to be practised, much advantage will be derived from the preliminary application of the Esmarch bandage, any necessary dissection being thus rendered very much easier. The elastic cord or band is much to be preferred to the ordinary tourniquet, for the temporary control of bleeding, until it may be practicable to effect a formal ligation. In a paper presented at the late International Congress, at London, Prof. Esmarch laid down, among other propositions, the following, which must command the assent of all surgeons:—

The practice, formerly in use, of ligating arteries above the wound, is uncertain, and ought therefore to be entirely discarded. The application of styptics is equally objectionable, not only because of their uncertain action, but because they foul a wound and interfere with its healing. The use of styptics is very objectionable; all such remedies ought therefore to be banished from the surgeon's field case. In all cases of hemorrhage threatening life, the wounded vessel must, if possible, be exposed at the seat of injury, and ligatured above and below this point, either with catgut or antisepticized silk. The most effectual method to render such an operation easy, rapid, and thorough, is to make a free incision parallel with the axis of the limb. When life is at stake, it matters little whether such an incision is one inch or one foot in length, provided that the hemorrhage is arrested, and that the wound is kept sweet; the large wound heals just as well as the small one. After freely incising the skin, the operator inserts his left index finger deep into the wound, and, with a button-pointed bistoury, opens up just as freely the deeper layers of connective tissue, fasciæ, and muscles, while an assistant now separates the parts with retractors. The blood-clot, which is generally found to fill the wound, and to have infiltrated the surrounding cellular tissue, is now rapidly turned out, either with the fingers, or sponges, or raspatories, partly because it hides everything, and partly to avoid subsequent decomposition. It is only under these circumstances that any operation can be carried out with anything like exactitude. As soon as this is done, the operator feels with his finger for the vascular and nerve trunks, and endeavors with the aid of a clean sponge to learn the exact nature of the injury. When the large veins are empty and collapsed, it is sometimes difficult to distinguish them from strands of connective tissue. On this account it is advisable to provide a little reserve of blood, which may be done in this manner. For the arm, a cord may be fastened around the wrist, below the wound, before the elastic (Esmarch) bandage is applied; then, on loosening this cord and raising the arm, the blood shut up in the hand will, if the vein be injured, flow into the wound, and so make it manifest. As soon as the injured spot of the artery or vein has been laid bare, so that its full extent can be clearly seen, the vessel must be isolated and then securely ligatured, either with catgut or carbolized silk, above and below the injury. If the continuity of the vessel has not already been destroyed by the injury, the vessel must be cut between the two ligatures. The operator should convince himself that no lateral or deep branches are given off to the injured part of the trunk. Should any small branches be found, they ought to be carefully isolated, ligatured, and then separated from the parent trunk. The Esmarch bandage should now be removed, and all bleeding vessels carefully tied, the limb being raised, as after amputation.

Occasionally, the nature of the wound, the position and condition of the bleeding vessel, and the state of the patient, will render it advisable, instead of attempting to control the hemorrhage in any of the above-mentioned ways, to at once perform amputation. Such an operation is much less likely than ligation to be followed by recurrence of the bleeding, the artery very probably being secured at a point where its coats are healthier, and, still more, the *vis a fronte*, which has so much to do with the production of secondary hemorrhage, being altogether removed.

TREATMENT OF SECONDARY EFFECTS.—Aside from the relieving of pain and shock, and the arresting of hemorrhage, the general treatment of gunshot wounds, as ordinarily practised, is very simple, having reference to the moderating of inflammation, and to preventing, as far as may be possible, the development of the secondary local and general infections already referred to. As in other injuries, the maintenance of rest, whether effected by position, by skilful bandaging, or by immobilization, is of great importance. The application of cold, by wet cloths, by irrigation, or by ice-bags, is very generally found to afford comfort and to moderate inflammation, but is not to be employed as a mere matter of routine, but judiciously, with reference to the indications of the particular case; repair has often been much delayed by the too long continuance of cold dressings. Occasionally, though rarely, warm applications prove much more comfortable. In former times, enlargement of the track of the wound, by incision, was the regular practice, and it is still advocated by a few surgeons of eminence, especially among the French, the object sought being to provide a readier outflow for fluids, and to prevent, by division of the fibrous and aponeurotic tissues, any strangulation of the underlying parts. Such immediate dilatation, however, is not at the present day favored by the majority of surgeons, who believe, with Hunter, that the track should not be opened merely because it is a wound, nor unless " there is something necessary to be done which cannot be executed unless the wound is enlarged."

With the object of converting the existing contused and lacerated wound into a simple subcutaneous one, Simon, half a century ago, advocated cutting away the edges of the wound, and suturing the incised skin margins, so that they might unite by the first intention; and thirty years later, Chisolm wrote: " Many ragged wounds may have their edges pared off and then be brought together, with every prospect of speedy union, provided the after-treatment with cold dressing is judiciously followed." Against such a method of treatment, it has been truly said, " both reason and experience protest."

Of extreme value, in the treatment of gunshot injuries, is the observance, as far as may be practicable, of the ordinary hygienic rules; the part and the person are to be kept clean, sufficient fresh air secured, proper food in due amount administered, overcrowding prevented, and the subjects of infectious wound-diseases isolated. A very large percentage of the deaths after gunshot injury are from preventable causes, or causes that would be preventable were it not for the exigencies of military service. Though it must necessarily be of primary importance to cripple and destroy the enemy, and only of secondary importance to save the wounded, yet there is no good reason for crowding men into churches, and barracks, and warehouses; and still less for continuing the occupation of such buildings as hospitals, long after they have become mere hot-beds of infection.

TREATMENT OF COMPLICATIONS.—*Traumatic Gangrene*, when complicating gunshot wounds, and consequent upon extensive blood infiltrations or inflammatory effusions or exudations, follows the same course, and is to be treated in the same manner, as when associated with other severe injuries—special interest attaching to it only when dependent upon excessive violence, destroying at a blow the vitality of the limb, or when due to occlusion of the main artery; the latter is by far the more frequent occurrence. In either of these cases, amputation should be performed at once. As a general rule, it may be declared that when mortification of an extremity sets in after a shot wound of the main artery, or vein, or both, removal of the limb should be effected as soon as possible, and on a level at least with the point at which the vessel is injured. There should be no waiting for the establishment of a line of demar-

cation, for in the great majority of instances this does not form, but there is a rapid and uninterrupted, upward progress of the gangrene, and early death; the exceptional cases of spontaneous arrestation serve only to prove the rule. It is in the lower extremity that the death-in-mass thus occasioned, is usually seen, as a result of a wound of the femoral or popliteal artery. As has already been mentioned, in cases of such injury, a successful result will frequently attend amputation just below the knee, the blood carried through the unharmed profunda artery sufficing to keep alive the parts around and above that joint. In all cases of traumatic gangrene, great attention must be paid to the hygienic surroundings of the patient, and to the proper administration of food, stimulants, and tonics.

Hospital Gangrene.—In the treatment of hospital gangrene, two things are aimed at: the arrestation of the local mortification, and the prevention of the spread of the disease.

The former indication requires that the wound should be carefully cleansed, and then thoroughly cauterized. The strongly adherent sloughs will usually have to be taken away with forceps and scissors (or knife), any existing pockets or sinuses being freely laid open; and the work of removal is to be continued until "we meet evidences of vitality, or by hemorrhage are warned to go no further." (Weeks.) The parts are next to be well scraped —to still further get rid of the diseased tissues—freely washed with warm water, plain or carbolized, and afterwards dried by the application of lint, oakum, absorbent cotton, or blotting paper. Then, and not until then, the cauterization is to be accomplished, and the utmost care must be taken that no portion of the wound is left untreated. Of the many cauterizing agents that have been used, the best are the hot iron, nitric acid, the permanganate of potassium, the perchloride and the persulphate of iron, and bromine. Turpentine, sugar, glycerine, and camphor have been largely used, but the results, though satisfactory in the milder cases, are not such as to warrant the adoption of these agents in preference to those previously mentioned. During our late war, bromine was found by the majority of surgeons who saw much of the disease to be the most reliable application, promptly stopping local extension, and promoting rapid healing.[1] In the few cases that came under my own observation, the permanganate of potassium was employed with very satisfactory results.

The acute pain, which is often so prominent a symptom of the disease, necessitates the use of opium or morphia, in full doses, or, as has lately been recommended, chloral, which, however, can act only as a calmative or hypnotic; when it will answer the purpose, it is preferable to opium, as not impairing the appetite nor producing constipation. Hemorrhage, if it occurs, is to be arrested in the ordinary way, by the application of the actual cautery, or one of the salts of iron already mentioned, if the bleeding is from the general surface; by the use of the ligature, if it is from a vessel of some size. The patient is to be well nourished, and stimulated if necessary; the bad effect of depressants was long ago established. An abundant supply of pure air is always to be secured.

To prevent the spread of the disease, those affected must be separated from the rest of the wounded, and there should be absolutely no communication between the gangrenous and non-gangrenous patients, whether by attendants, by dressings, or by currents of air. An infected ward or an infected hospital should be abandoned—permanently if possible, but, at all events, temporarily.

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[1] F. H. Hamilton, Jr., showed that the average duration of treatment was less than one-half of that after the application of nitric acid.

If, however, its occupation must be continued, though this seldom need be the case in military practice, we have in antiseptic surgery, as we shall see hereafter, a more or less complete protection for its wounded inmates. Hospital gangrene ought not to appear spontaneously in a hospital, and its development *de novo* is a positive proof of maladministration—the fault being either in the building, its ventilation, or its drainage, or in the responsible officer, by his permitting or compelling over-crowding. The disease may, however, be brought into any hospital, no matter how well managed, and the most prompt isolation may not always prevent infection; but only by isolation can the spread of the affection be prevented.

Pyæmia, Septicæmia, etc.—The treatment of the other so-called "hospital diseases," septicæmia, pyæmia, and erysipelas, when they occur as complications of gunshot wounds, differs in no respect from that which is appropriate when they are met with in ordinary civil practice. If possible, their subjects should be taken out of hospital, and placed under more favorable hygenic conditions.

Sédillot has declared that he has "seen numerous examples of wounded men attacked with pyæmia, who had recovered after amputation, after having been moved to other more salubrious places;" and amputation or resection is always indicated in severe wounds, especially of the larger bones or joints, when this complication appears.

Tetanus, when it occurs, which is fortunately not very often, cannot, if acute, be controlled in the vast majority of cases by any treatment whatsoever. Notwithstanding the fact that, since the days of Hennen, curare, calabar, chloral, and the bromides have been introduced, and each declared to be curative, the surgeon must still say, with that author, " My observations have tended more to show me what I could *not* trust to, than what I could place the smallest reliance on, when the disease was once fully formed." Amputation and nerve-stretching have occasionally been followed by recovery, but usually by death. Of the four cases of recovery from the acute form of the disease reported from our army during the war of the Rebellion, two were after amputation. The cases of tetanus among the wounded of the great wars of the last twenty years " have not modified the conclusion of Romberg, that, wherever tetanus puts on the acute form, no curative proceedings will avail, while in the milder and more tardy form, the most various remedies have been followed by cure." (Otis.)

ANTISEPTIC DRESSINGS IN GUNSHOT WOUNDS.

As respects the general treatment of gunshot wounds, the most interesting question of the day is: What is the value, and how wide the applicability, of the antiseptic dressing in this class of injuries? Almost all the deaths after gunshot wounds, which are not fatal because of the vital importance of the parts damaged, are consequent upon protracted suppuration, or upon the inflammatory complications which have been noticed. Eliminate these mortiferous causes, and the prognosis at once becomes comparatively favorable. Is it true, as averred by MacCormac, that " it is not the presence of the ball, nor the fact of the bone being splintered, which occasions inflammation and suppuration, but the entrance of septogenic matter from without, or of pieces of soiled clothing carried in by the ball ?" or, as declared by Nussbaum, that " the fate of a wounded man depends almost entirely upon the surgeon who treats the wound during the first hours ?" That in the past few years, in

civil practice, severe compound injuries, very analogous to those produced by gunshot violence, have under this plan of treatment been recovered from in extraordinarily large numbers, is a fact that cannot be disputed. That local and general diseases, unquestionably consequent upon wound-infection, have been very greatly lessened in frequency of occurrence, and that, too, in hospitals where previously they had been most prevalent, is undeniable. Are the changes that have lately taken place in the course of wounds due to their less frequent disturbance, their more careful cleansing, their more complete drainage; or are they due to the employment of germ-destroying agents, or to the filtration of septic organisms from the air that is permitted to come in contact with the injured tissues? The question may be readily answered; but will future experience prove the correctness of the answer?

If the "antiseptic treatment" is to be carried out in its strictness, the injured man must not be touched until it is possible to antiseptically explore the wound, remove the foreign bodies, make the necessary counter-openings, put in the required drainage-tubes, and apply the investing coverings and bandage.

Fig. 254.

Bardeleben's antiseptic tampon.

All this can never or only very exceptionally be done on the field; and the primary dressing must consist in simply covering the wound with an antiseptic tampon of "salicylic wool contained in salicylic gauze, and inclosed in a square of oiled paper" (Esmarch), or of "chloride of zinc jute inclosed in gauze" (Bardeleben), and holding this tampon in place by a bandage. Possibly, some other agents (such as boracic acid, eucalyptol, or iodoform) may hereafter prove more advantageous and of easier application.

"Nothing is more diastrous to the possibility of an aseptic course than the 'regulation search' immediately after the receipt of the injury, and the repeated examination of the wound by the finger or instruments to discover the ball, or to diagnose the extent of the damage to the bone. It is impossible for either finger or instrument to be clean." (MacCormac.)

No harm will result, it is claimed, from a delay of one or even two days in the examination of the wound, providing that the above mentioned tampon is kept constantly applied, a clean one being substituted for the soiled one as often as may be necessary. Cammerer, in the Servian war, found it possible to render the wound aseptic even as late as two weeks after the receipt of the injury. If fracture of an extremity has occurred, immobilization is to be at once effected as perfectly as may be possible. When the patient has finally reached the "thoroughly well organized hospital" in which he is to be treated—

"Any foreign bodies (bullets, bits of bone, fragments of clothes) which may be found, should be removed. Should any nerve trunks or tendons have been divided, their extremities must be sought for and sewn together, either with fine catgut or carbolized silk. The whole wound must now be thoroughly disinfected, either by irrigation or by rubbing in chloride of zinc or strong carbolic solution, taking care that the fluid gets into every little recess. After counter-openings have been made in suitable places, and drainage-tubes put in, the wound must be closed with antiseptic sutures, and finally the antiseptic compressive dressing applied." (Esmarch.)

The results of this system of treating severe gunshot wounds, as practised by one or two of the few surgeons who have made considerable trial of it in recent wars, we shall notice hereafter, when upon the subject of bone and joint injuries. Early in 1871, A. Guérin, having, during the preceding six months of the siege of Paris, lost all but one of his amputation cases, adopted

the *cotton-dressing*, intended by filtration to exclude all atmospheric germs; and, as the result of such treatment, of thirty-six patients submitted to amputation from April to June, but thirteen died; one-half of the thigh amputations were saved. Originally placing the cotton directly upon the surface of the wound, and keeping its edges apart, Guérin subsequently so modified this dressing that it was placed upon the cutaneous surface of the flaps, previously brought together by several points of the interrupted suture. The advantages claimed for this method of dressing, besides its germ-excluding power, are the gentle and elastic pressure which it exercises, and the uniform and sufficiently elevated temperature which it maintains. It has never been much employed except by a few of the French surgeons, and by them chiefly or only in the treatment of amputation wounds.

Gunshot Injuries of Bones and Joints.

Aside from penetrating wounds of the cavities and injuries of large vessels, the great majority of dangerous gunshot wounds are those involving bones and joints.

Contusion of Bone.

When it is struck by a ball, a bone may be either contused or broken. As the result of a grazing shot, moving at a high rate of speed, or of the more direct blow of a small or large body whose velocity is not sufficient to produce fracture, the osseous tissue may be bruised; the consequences of such an injury differ from those of contusion of the soft parts only as far as they are necessarily modified by the peculiarities of histological structure. There may be either a simple jarring, attended by no appreciable symptoms other than those of the associated injury of the overlying tissues; or, what more often takes place, there may be limited blood extravasation and consecutive inflammation; or, as has been occasionally noticed, there may be immediate death of the bone at the point struck, and for a variable distance around. The first of these morbid conditions is of little importance, and is quickly recovered from, while the last can only result in the loss of the damaged part, the process of separation beginning very early, and being completed usually in from six to eight weeks; the thickness of the separated piece varies from that of the most superficially exfoliated scale to that of the bone itself, as, for instance, the two tables and interposed diploë of a part of the cranial vault.

As, ordinarily, contusion of the soft parts causes inflammation of them, so contusion of bone gives rise to periostitis, osteitis, or osteomyelitis—the three essential parts of bone (periosteum, bone proper, and medulla) being commonly associated in the morbid process. This inflammation ends in its usual ways: in resolution, in new formation, in gangrene or in suppuration, circumscribed or diffused; the two last mentioned terminations are by far the most important. Not so very seldom, *necrosis* involving a considerable part of a long bone is produced by the jarring and resulting osteitis of a raking shot. I have had occasion to remove from the tibia a sequestrum 8 inches in length, which resulted from the passage of a bullet across the bone just below the tuberosity; and Lidell has reported a very similar case (the bullet passing "across the tibia about four inches below the patella, bruising the bone and slightly grooving the surface"), in which, five months after the receipt of the wound, "a large part of the shaft of the tibia was necrosed and loosened, but not sufficiently detached to justify removal by operation."

Suppuration may be either periosteal or the result of osteo-myelitis. In

the compact tissue, it may or may not be associated with necrosis, and in the medullary cavity, may involve either isolated portions of the medulla—the pus being in small, distinct pockets—or may be diffused. In diffused medullary suppuration, which is always consequent upon a high degree of inflammation, and which generally occurs in debilitated subjects, or in those placed under most unfavorable hygienic surroundings, the medullary canal is filled with a mixture of unhealthy pus, blood, and broken down marrow. In this putrid osteo-myelitis, especially when affecting spongy bones, moist gangrene (the *mephitic gangrene* of Lidell) may, though rarely, be developed; the bone being "moist, dirty gray, dirty pale green, or dirty greenish-brown in color, and exhaling to a greater or less extent the intolerably offensive odor of rotting bone."[1] These suppurative inflammations are very likely to give rise to general infection, and a large percentage of their high mortality is due to pyæmia. As Fayrer has said, "it is not the mere local mischief that one dreads, although that may cause the loss of the limb. It is the constitutional disease to which it gives rise   .   .   .   that we must consider the great source of danger."

There may be, in the milder cases, no symptoms other than those referable to the accompanying injury of the soft parts, and even when there has been killing outright, delay in healing or re-opening of the apparently closed wound may at times be the only effect produced by the presence and elimination of the dead bone. In the severer inflammations which yet do not terminate in pus formation, the osteitis may generally be diagnosticated by the character of the pain and the nature of the swelling of the affected part; as it may in the milder, externally located, suppurative cases, after a time, by the added discharge of pus, the detection with the probe of denuded bone, and the associated constitutional symptoms. In the very grave form of osteo-myelitis which is ushered in with a chill and attended with delirium, the acute inflammation, if it does not cause death within a few days, is likely to abate, and recovery may ultimately take place after separation of the necrosed bone. In many of these cases, there comes on "from the tenth to the twenty-fifth day a new fever, with an intense initial chill followed after a day or two by several more; then all the symptoms of purulent infection are developed. As death is the ordinary termination of this complication, an autopsy permits us to recognize the lesions of putrid osteo-myelitis, and often, at the same time, those of a suppurative phlebitis which is equally putrid in most of the cases of this sort." (Gosselin.)

TREATMENT.—When there are no symptoms apparent, except those of an ordinary contusion or wound of the soft parts, treatment of the latter is all that will be required. When to these are added symptoms indicative of necrosis, nothing should be done until the dead piece is separated, when it should be speedily removed. In the much more common cases of periosteal or osseous inflammation, if the symptoms are at all grave, the surgeon, in addition to the ordinary constitutional and local antiphlogistic treatment, should make a free incision through the periosteum, and, if the disease is not superficial, a longitudinal section of the bone with a Hey's saw; or should open the medullary cavity with the trephine.

If a considerable part of the shaft of a long bone is found to be involved, or if the severity of the constitutional symptoms shows that the disease is of the diffused, suppurative, or gangrenous form, amputation in contiguity, at the articulation next above, should be resorted to at once; and even when pyæmic symptoms have manifested themselves, the patient may occasionally,

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[1] A like condition is at times met with in long bones "as the result of violence which *suddenly* deprives the part of its vitality."

though rarely, it is true, be saved by such an operation. Amputation in continuity, except in slowly progressing cases, is of no benefit, the disease quickly re-appearing above the line of section. When the symptoms are less acute, and the patient has survived the dangers of the earlier weeks or months after the receipt of the injury, secondary disarticulation may be practised with strong probability of a successful result. A chronic osteomyelitis—not likely to follow contusion, but not infrequently met with after gunshot fracture—may spontaneously terminate in the death of the affected part, removal of which will be soon followed by complete recovery from the injury; or it may slowly but very surely go on to the involvement of the whole bone, necessitating amputation at the joint above. The progress of this form of the disease is at times exceedingly slow.[1]

If possible, infectious bone-inflammations should be prevented rather than treated, and it is to protection against the occurrence of these septic processes, and thereby against blood-poisoning, that methods of dressing must in the future be directed. "Listerism" has already been tried on a limited scale in these cases, and in civil practice it can, under favorable circumstances, be thoroughly carried out; but in military surgery, it must ordinarily, or at least often, be almost if not altogether impracticable. As far as can possibly be done, the parts should be kept quiet and clean, free drainage secured, over-crowding prevented, and abundant fresh air supplied.

Fracture from Gunshot Injury.

Of greatly more frequent occurrence than *Gunshot Contusions* of bone are *Gunshot Fractures.*[2] These fractures may be *simple* (in only a few cases, and then almost always not directly produced by the impact of the projectile), or *compound;* they may also be classified as *fissured,* as *comminuted*— sometimes extensively, with a variable amount of scattering of the fragments —as *penetrating,* as *perforating,* or as "*resecting*"—the missile carrying away the entire thickness of the bone for a greater or less distance, with little or no associated splintering. The extent of damage done depends in great measure upon the size and velocity of the shot, and has been therefore found to be much greater in recent wars than formerly. In a comparatively few cases, round balls or pistol bullets or, yet more rarely, the modern, elongated rifle ball, has bored through a bone (if a long one, usually near an articulating extremity) without producing any splintering,[3] the osseous tissue being in part condensed, in part carried on into the neighboring soft structures. Penetration with lodgment may occur, even (though but seldom) in a diaphysis, without other bone lesion. But in the great majority of cases, when a ball strikes a bone, it either splits it or shatters it according to the manner in which the force is applied. The conical bullet exerts a wedge-like action: striking an epiphysis, it may simply fissure it, the cracks extending "perpendicularly upwards and downwards without perforating the articular cartilages. Such fissures are more or less frequent, especially when great force is applied, i. e., when the channel made by the shot is long."

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[1] In a case under my care, in which, in October, 1880, I successfully amputated at the hip-joint, the operation was rendered necessary by a gunshot fracture of the femur in its middle third, which had been received 33 years before in the battle of Molino del Rey, Mexico, in September, 1847.

[2] Of more than one hundred thousand (107,898) wounds summed up by S. W. Gross, nearly ten per cent. (9.64) were fractures of long bones, including among these the clavicle and scapula.

[3] Becher reports having seen a number of such cases, the wounds having been made by the chassepot bullet of 380 grs. weight.

The diaphyseal fractures, according to Bornhaupt, "sometimes resemble a stick bent in its longitudinal axis; or a ring compressed from two opposite sides. In the first case, there may be simple transverse fracture[1] (mostly through spent bullets); in the second, two, three, or four longitudinal fissures. If the diaphysis be injured more towards the middle part, then the two mechanisms combine in the production of a peculiar form of fracture, viz., the 'spiral longitudinal fracture.' The bone divides into four fragments; in addition to an upper and lower fragment, two triangular splinters are to be found opposite the part which has been struck, forming the posterior longitudinal fissure. When the bullet has not hit directly the posterior wall of the bone, the longitudinal fissure originates through direct force, and not through the hydraulic pressure of the marrow." It is to this "pressure developed by projectiles in the liquids which they traverse," that Kocher has attributed, "in great measure, the lateral splintering produced by the ball." Otis has called attention to the fact that when the femur has been struck by a heavy conoidal ball, in addition to the damage at the place of impact, there is, at times, an added transverse fracture two or three inches above or below, according as the shot has struck below or above the middle of the shaft.

However extensive the splintering, if consequent upon a bullet wound, the fissures generally, at least in children and young adults, do not extend beyond the epiphyseal line; and in some cases in which they run through the articulating extremity, "the synovial membrane remains intact, and the joint is not opened."

It would appear from the observations and experiments of Kircher and Longmore, that though there is, as the result of the blow of the conoidal bullet, more extensive splintering than when the injury is inflicted by a round ball, there is not so much separation of the fragments, which are to a considerable extent held in place by untorn periosteum; and, further, that the hardened bullet does not as extensively comminute nor as widely scatter the pieces of the broken bone as does the soft lead one. In accepting this latter conclusion of Mr. Longmore, due allowance must be made for the difference in diameter of the bullets used, that of the Enfield pure-lead ball being .55 in., and that of the Martini-Henry lead-and-tin ball .45 in. The probability of recovery with preservation of a useful limb, if the wound is located in one of the extremities, is, of course, much greater, other things being

[1] In the Army Medical Museum at Washington there is a specimen of "the left clavicle transversely fractured, without comminution, directly in the middle. (Fig. 255.) The missile

Fig. 255.
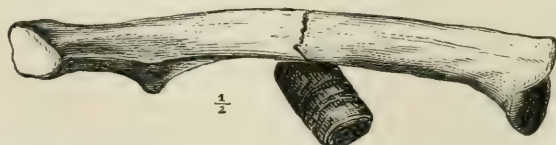
Transverse gunshot fracture of right clavicle by conical ball. (A. M. M. Spec. 1210.)

was a conoidal ball which entered near the third dorsal vertebra, fracturing the corresponding rib at its angle, and was found after death encysted immediately beneath the fractured point of the clavicle." MacCormac reports a case in which "the ball entered on the inner side of the right thigh, close to the perineum, and after traversing the femur just beneath the lesser trochanter, emerged on the outer side of the thigh. There were, when first examined, two inches of shortening and great deformity. The fracture must have been almost a transverse one, for the bone, after considerable extending force had been applied, went into its place with a jerk, and there remained. The patient recovered without a bad symptom, and the most accurate measurements failed, six weeks afterwards, to detect any appreciable amount of shortening."

equal, when the fragments are held in close apposition than when they are separated; and Kircher, who declares that wounds from conical bullets heal more readily than those from round ones, believes that there is at times, because of the fixation of the pieces by their unruptured periosteal covering, union of the fracture without suppuration.

Fig. 256.

Fig. 257.

Fissured gunshot fracture of right humerus removed by amputation. (A. M. M. Spec. 486.)

Fissured gunshot fracture of right femur by conical ball. (A. M. M. Sect. 1, Spec. 3931.)

The danger to life in gunshot wounds of bone lies in the liability to the occurrence of fat-embolism, of violent inflammation, of blood-poisoning, or of exhaustion or amyloid disease from profuse and protracted discharge of pus.

TREATMENT OF GUNSHOT FRACTURES.

The treatment of gunshot fractures must have reference to the condition of the injured part, and to the various constitutional symptoms which may be developed. *Primary* splinters, that is, those entirely detached, should be removed at once. Upon this all are agreed, unless the case is to be treated antiseptically, when, as we have already seen, the cleansing of the wound and removal of foreign bodies (and such are these bone fragments) are to be postponed until circumstances will permit of a systematic dressing, or, indeed, may be omitted altogether if the pieces are not large—some (as, for instance, Schmidt, of St. Petersburg) going so far as to declare that extraction of splinters is only necessary when sepsis has occurred. Whether or not *secondary* sequestra (those still somewhat attached) shall be taken away, must depend upon the extent and degree of their adherence. If simply held by narrow bands of periosteum, the sooner they are removed the better, for their vitality cannot long be maintained. If more firmly united to the unbroken part of the bone, even though standing off at a considerable angle, they will often, if left undisturbed, be included in the callus, and contribute effectually to its development and strength; the disadvantage of their retention is the danger of necrosis, and the consequent persistence of sinuses until the dead fragments

are removed. Great annoyance and even fatal visceral disease are sometimes caused in this way. Necrosis may thus occur years after the apparent firm consolidation of the fracture, when from any cause whatever the general health becomes seriously impaired.

In cases of fissuring without separation, or where the periosteal investment of the fragments is not much disturbed, these should be left untouched. In gunshot as in all other fractures, it is of the utmost importance to hold the fragments in apposition, as far as can be done; and no matter what bone it may be that is damaged, rest as complete as possible of the injured part should be secured—by dressings, if they can be applied—otherwise, by position. In the extremities, where, according to Sédillot, " ever since firearms have been used on the field of battle, and in sieges, the same question has always presented itself to surgeons: viz., in what cases should fractured limbs be saved, or sacrificed in part (resection), or in whole (amputation)?"— if an attempt at preservation is made—the injured part together with the joints next above and below should be at once immobilized. The less the wound is disturbed, and the more completely movement of the fragments is prevented, the better are the chances of recovery.

To secure the necessary quietude of the damaged tissues, the application of a plaster-of-Paris dressing[1] is of great value, and it matters little what particular form of the dressing is employed—the continuous roller, or the Bavarian, or longitudinal strips—provided that the immobilization is sufficiently made, and, what is of much importance, that the wound itself is not covered in, and the limb not constricted at that level. If the patient is not to be moved, and can be constantly kept under proper observation, the latter point need not be so much regarded, since the investing bandage can be at once sufficiently cut open if the swelling necessitates it. It has been objected to this method of dressing that the opening opposite the wound weakens just where there should be the greatest strength; that the splint will soon break in transportation; and that it quickly becomes soiled by the discharges, which both render it offensive and rapidly soften it so that it no longer possesses the requisite firmness. These are certainly not insuperable objections; the fenestrum may be bridged over with a piece of tin, iron, wire-gauze, or even wood; a properly made bandage will stand the jolting of any ordinary transportation; and, by the use of oiled silk or thin rubber cloth, the fluids from the wound can be kept off the plaster. Great advantages are claimed for wire-gauze splints, that can by pressure of the hand be moulded to the shape of the broken limb, and yet are firm enough to keep the parts quiet, and to permit the patient to be removed, if necessary, by ambulance or rail.

Beside external support, there must be protection from the danger consequent upon the retention of extravasated blood and effused serum; in other words, free drainage must be secured by counter-openings, by position, or by tubes, one or all. A gunshot fracture does not differ from an ordinary compound fracture, except in the frequent smallness of the wound in comparison with the extent of the injury, and the same general principles must govern the treatment of both sets of cases. The essential requisites for successful conservatism, in either case, are the securing of rest, cleanliness, and thorough drainage. Future experience must determine the value of the antiseptic dressing. As we have already seen, its formal application on the field is, at least in its entirety, seldom practicable; yet the comparatively few trials that have been made of it in military surgery, show very clearly that its primary application, before inflammation has set in, gives very much better results than those

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[1] The use of plaster was recommended as long ago as 1814 by Hendriksz, of Holland, and Pirogoff employed the plaster bandage in 1854 during the Crimean war.

obtainable when it is secondarily resorted to. Reyher, for instance, out of 22 cases treated in the former way, lost but 4, or 18.1 per cent. (from septic inflammation 1, from pyæmia 1, from fat embolism 1, from extravasation 1); three of these (out of six in all) being wounds of the thigh, and one (out of three) a wound of the forearm, while of 65 cases in which the antiseptic method was only applied secondarily, 23 (35.2 per cent.) terminated fatally: 5 of the arm, out of 12 cases; 13 of the thigh, out of 25; and 5 of the leg, out of 22—13 of these 23 deaths having been from septic phlegmon and pyæmia.

Exsection in Gunshot Fracture.

Putting aside, for the present, excisions of the articular extremities for fractures involving the neighboring joints, and taking no account of removals, more or less extensive, of detached fragments, with or without associated cutting away and rounding off of the sharp ends of the upper or lower unbroken parts of the diaphysis, there remain for consideration *Resections in Continuity*, and entire *Extirpations* of fractured and necrosed bones. It may be said in general, of the former operations, when primary, that the mortality which attends them is higher than that of the simpler informal removal of fragments, and that the ultimate results, as far as the functional value of the damaged parts is concerned, are no better, if as good. It should never be forgotten that, as Sédillot has said, these resections, "sanctioned neither by theory nor by experience, . . . cannot be done without great disturbance and violence, and an unavoidable increase in the extent of the wounded surfaces." Nor can early, complete extirpation be regarded more favorably; only exceptionally can it be justified, and, even then, as satisfactory a result would probably follow extraction of the entirely detached pieces of the broken bone, or, on the other hand, it might be better to amputate. Secondary operations, whether partial or complete, for necrosis, or more rarely for caries, may be both proper and necessary; and they should be determined upon, and executed, upon the same general principles as when the death of the bone has resulted from causes other than gunshot injury.

Amputation for Gunshot Injury.

Excellent as are the results that frequently attend attempts to save fractured limbs, in an unfortunately large number of cases removal of the injured member will prove to be the truest conservatism, the lesser being sacrificed for the good of the greater. Joint injuries excluded, when should amputation be resorted to?

(1) When there has been *great destruction of soft and hard parts*, as in a crush by large shot, or when the limb has been almost completely or altogether carried away. Under such circumstances, the operation would naturally be performed at once, and, if possible, at a high enough point to get above the region of contused and blood-infiltrated tissues.

(2) When the fracture is associated with *laceration of the main vessels or nerves* of the part, though, as will hereafter be seen, in certain regions such complicated fractures may be conservatively treated with good prospect of success.

(3) When *acute, infective osteo-myelitis* has been developed. In the *chronic* form of this disease, when the entire length of the bone has become affected,

Fig. 258.

it may or may not be necessary to amputate, according to the general condition of the patient and the particular bone that is diseased. If the general state is good, and the affected bone not absolutely required for support, excision may very properly be substituted, unless it be apparent that the result can only be an useless limb. Even in such a case as that reported by Cutter, in which, after a primary excision of the head of the humerus and a small portion of the shaft, the remainder of the humerus and the elbow-joint were removed by a secondary operation—notwithstanding that it was declared two years later that the limb hung pendulous and useless—still, if the man was able after steadying the forearm to satisfactorily use his fingers, he was certainly better off than if there had been a disarticulation at the shoulder. In many of the cases of chronic osteomyelitis of the bone or bones of a stump, reamputation in contiguity is unnecessary, it being sufficient to fully expose the end of the bone, and forcibly pull out the sequestrum.

(4) When there is severe *secondary hemorrhage* from an eroded vessel, or from a ruptured traumatic aneurism.

Necrosed lower part of humerus, with parts of radius and ulna removed by excision. (Cutter.)

(5) When *traumatic gangrene* has supervened. The development of *tetanus* may also be deemed an indication for amputation. In cases of gunshot injury other than those involving the bones and joints, amputation may be rendered necessary by the large extent of the laceration, by the injury of the great vessels or nerves, or by the complication of gangrene or tetanus.

When evidently necessary by reason of the locality and extent of the injury, amputation should be resorted to as soon as shock has been sufficiently recovered from, before the development of inflammation, which may show itself some hours, or not for several days, after the receipt of the wound—ordinarily in not less than eight nor more than twenty-four hours. Even at the hip, Otis's observations "do not sanction the conclusion that ablation of the thigh is an exception to the general rule requiring amputations that are indispensable to be done immediately." These *primary* operations are much less fatal than those which are performed during the period of active inflammation[1]— the so-called *intermediary* operations—when indeed no avoidable surgical interference of any kind should be permitted. With the subsidence of acute inflammatory symptoms, and the thorough establishment of suppuration—in from ten to thirty days, according to circumstances—begins the period of *secondary* amputations, the mortality of which is between that of the primary and intermediary. As in removal of limbs on account of the ordinary injuries of civil life, no more should be taken away than is absolutely necessary; but as a gunshot injury generally damages parts at a considerable distance above the point struck, the place of operation must be selected accordingly. An amputation in contiguity should always be preferred to one higher up, if the condition of the soft parts will permit; for instance, through

[1] In nearly ten thousand (9891) primary amputations in military surgery tabulated by Ashhurst, the mortality rate was 37.6 per cent., while that of 3775 late operations was 43.3 per cent., and a large proportion of these were undoubtedly secondary. (See Vol. I., page 629.)

the knee-joint (or at the knee), rather than at the lower third of the thigh.[1] As a rule, having, however, numerous exceptions, such an amputation is also to be preferred to one in continuity just below, as, for instance, that through the tuberosities of the tibia, which was so much favored by Larrey. The head of the humerus should be saved, however, when possible, since the resulting stump is more shapely than that of amputation at the shoulder, and less likely to be injured in after life (not "useless and inconvenient," as declared by Larrey); again, if an inch or more of the bones of the forearm can be left, the resulting hook, in cases in which the motions of the elbow are preserved, is of great service; and a successful Pirogoff amputation gives a longer, firmer, and better stump than a Syme.

The operative procedure to be adopted in any given case, must depend upon the locality and the condition of the damaged part, and the subsequent mode of dressing should be determined upon the same principles as those governing amputations in general. If the antiseptic system is not adopted, care must be taken to at least secure thorough drainage. Notwithstanding the excellent results that may at times follow the "open treatment," it is, as a rule, desirable to secure union by first intention, as far as it may be possible to do so; and for this purpose bleeding from the cut surfaces must be arrested (preferably by the use of catgut ligatures and hot water); drainage-tubes should be inserted; and the parts should be closely apposed, and held together by one or two deep, and a sufficient number of superficial stitches, aided, if thought best, by the elastic compression of sponge or cotton, held in place by a methodically applied bandage. Due attention must always be paid to what has been styled the "surgery of salubrity."

Gunshot Injuries of Joints.

Joint wounds, which are both frequent and dangerous,[2] are of two classes: penetrating and non-penetrating—the latter class including wounds and contusions of the overlying soft parts, extending down to the capsule or secondarily causing synovial inflammation, and fractures of the extremities of bones running to but not into the adjoining articulations. Unless the joint has been widely opened, or there is escape of synovia, an early diagnosis of penetration cannot be made, even though the ball has passed in and out, and the line of direction seems to run through the articulation. In a few cases, the ligaments or other periarticular structures cause deflection of the missile, and, on the other hand, because of the length and nature of the bullet track, there may be no outflow of the joint secretion. When the diagnosis is uncertain, the wound is to be explored, if at all, only with the finger; the probe should never be used, for it might very easily pass through an unopened synovial membrane, and thus convert a non-penetrating into a penetrating injury. The chief danger, as in joint wounds otherwise caused, is that of the production of suppurative synovitis, with its resulting local

[1] Few American surgeons will agree with Legouest that the knee amputation is "a bad operation, more dangerous than amputation of the thigh in its continuity, and one that ought to be discarded from practice." Though the correctness of his statement that its mortality (88.7 per cent.) is 13 per cent. higher than that of amputation of the thigh, is sustained by the 88.2 per cent. death-rate of the French operations in the Crimea, and rendered probable even by the 78 per cent. mortality of the 41 cases in the Mexican, Italian, Austrian, and Franco-German wars, tabulated by Salzmann, it is thoroughly disproved by the fact that in our late war, when at least 211 such operations were performed, the death-rate of 202 ascertained cases was more than 14 per cent. *less* than that of thigh amputations, 50.2 per cent. against 64.43 per cent.

[2] Of 12,864 wounds tabulated by Longmore, 403 (3.13 per cent.) were of joints, and of these 130 (32.25 per cent.) proved fatal.

destruction, exhaustion, amyloid disease, or purulent infection; and gun-shot wounds of the articulations are more fatal than others, simply because they do more damage to the joint structures and cause a greater amount of hemorrhage into the articular cavity. When the joint has not been opened, the synovitis may be simple, and the prognosis consequently very much more favorable, but oftentimes intra-articular suppuration sooner or later occurs; the overlying structures at times become gangrenous, occasionally, without doubt, not so much because of the original injury, as of the injudicious use of cold applications, combined it may be with compressing bandages.

The extent of destruction of the soft parts may be so great as of itself to necessitate amputation; and in many cases, otherwise successfully treated, decided impairment of the joint or even fixation of it may result from peri-articular cicatricial contraction. In penetrating bullet-wounds, it has un-doubtedly happened once in a while that the missile has passed through with-out injuring the bones, but in the vast majority of these cases, osseous lesion is produced; rarely perforation, or even lodgment, without fissuring or smash-ing; almost always splintering, often in high degree. The early symptoms, even in these latter cases, are frequently very mild; there may be little or no pain, and no constitutional disturbance. The untorn periosteum may hold together the splintered fragments so firmly that it is difficult or impossible to elicit crepitus, and that it may be possible to use the injured limb, as in a case reported by Legouest, in which though there was a fracture of the coty-loid cavity, the man walked about for ten days after he was shot.

Usually, fever sets in on the second or third day. According to the joint affected, and the extent of its damage, an attempt may be made to save the limb, by cleansing the wound, removing foreign bodies (including all detached pieces of bone), securing drainage, immobilizing the part, and controlling inflammation, particularly by the application of cold; or the injured part may be taken away, either by complete or partial excision of the joint, or by amputation. Until quite recently, the non-operative treatment of wounds of the larger joints was attended with a greater mortality than either excision or amputation; and by the majority of surgeons, operation has been advised in all cases of such injury, excepting those which are very slight, or when the patient's surroundings are unusually favorable. Other things being equal, the chances of saving part and life are much better in joint wounds of the upper, than in those of the lower extremity. In the last few years, a number of severe injuries of the major articulations have been treated anti-septically, with results very much better than those previously obtained in military surgery—the great object being to prevent suppuration, with the setting in of which the chances of recovery decrease very rapidly. (Reyher.) Whether this or the ordinary treatment be adopted, immobilization is of the utmost importance, and equally so, in the ordinary mode of treatment, is the removal of foreign bodies. With the antiseptic dressing this is a matter of very much less importance, as is shown by two of Bergmann's cases in which healing took place, although, as was proved some time afterwards by post-mortem examination—the patients having meanwhile died of intercurrent disease—in one, several small pieces of cloth were shut up in the joint, and in the other, a fragment of bone had grown into the insertion of the crucial ligaments.

Whether, in cases that must be operated upon, exsection or amputation shall be preferred, will depend upon the extent of the laceration of the soft parts and of the destruction of bone, upon the particular joint injured, upon the general condition of the patient, upon whether or not he is to be treated at the place of operation, and lastly, upon his hygienic surroundings. If no use be made

of antiseptics, an amputation wound may be expected to heal sooner and with less suppuration than that of an excision.

The difference in the fatality of the two operations is not very great; the advantage on the side of exsection is, that, if successful, there remains an useful limb. Unfortunately, in no small proportion of the cases of joint removal, though life is saved, the part is of little, sometimes of no value. In about every fortieth case, Gurlt found that the limb was not only useless, but a burden; in one-ninth (75, or 11.5 per cent.) of the 652 cases the "end-results" of which he ascertained, the functional value of the part was *nil;* in one-half (322, or 49.38 per cent.), the limb could be satisfactorily and properly used only with the aid of some prothetic apparatus; in less than one-third (202, or 30.98 per cent.) was the part quite useful; and in only one in seventeen (38, or 5.83 per cent.) was the functional integrity of the limb completely regained. Occasionally, when the conditions have been exceptionally favorable, and when it has been possible to make the operation sub-periosteal and subcapsular, complete osseous regeneration has taken place, so that even in size and shape the joint has been restored. Practically, a *primary* sub-periosteal resection cannot be effected, and it is an useless waste of time to attempt it. Subsequent amputation has been found necessary in about one case in every twenty (152 out of 3161), with a resulting mortality of 48 per cent. (73 out of 152). Of late-occurring deaths of individuals operated upon more or less successfully, a very considerable number have been from pulmonary tuberculosis; but this form of disease is generally, it is probable, in no way consequent upon either the wound or its treatment.

As respects the time of operation, exsections, like amputations, are divided into the *primary,* the *intermediary,* and the *secondary;* of which the intermediary are most dangerous to life, and the primary least so.[1] Of the six larger joints, the shoulder and elbow are those much the most frequently exsected, the percentage being, according to Gurlt, for the shoulder 45.29, elbow 39.21, wrist 3.62, hip 3.79, knee 3.98, ankle 4.39; the shoulder and elbow together are thus operated upon eighty-five times in every hundred; or, in other words, nearly one-half of the exsections for gunshot injury are of the head of the humerus, and two-fifths are of the elbow.

Although perhaps more properly coming up for consideration under the general head of "injuries of the extremities," it is for many reasons preferable to notice in this connection the wounds of the several major articulations.

GUNSHOT INJURIES OF THE SHOULDER.

The frequent injuries of the shoulder-joint are almost always penetrating wounds, with fractures of one or both of the bones entering into its formation. There may, however, occur also a fracture without accompanying skin laceration, as from a large shot or shell fragment; perforation of the soft parts, with contusion of the joint-structures; penetration without osseous lesion —seventy-two cases of the two last-mentioned injuries were reported during our late war; or, rarely, splintering of the humerus from an injury of its

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[1] According to Gurlt's tables, of 1056 primary exsections, 317 were fatal (30 per cent.); of 286 intermediary, 131 (45.80 per cent.); and of 1622 secondary (not including "late" cases and those the time of performance of which was unknown), 610 (37.60 per cent.). That primary operations give the best results, is further shown by the fact that while of 141 German primary operations, 50 (35.46 per cent.) were fatal, and of 1126 secondary, 416 (36.94 per cent.); of 915 primaries during our late war, 267 (29.18 per cent.) were fatal, and of the 496 secondaries, 194 (39.11 per cent.).

diaphysis, the fissures running up to or into the epiphysis, without primarily opening the articulation. (Ordinarily, as has long been known, an epiphyseal line limits the fissuring, whether from a wound above or below.)

In the non-penetrating wounds, the joint may be " contused and wrenched, and filled with extravasated blood; more severely injured than from a simple penetration of the capsular ligament (Neudörfer)," since suppurative synovitis is likely to be developed. As regards the side of the body, the left shoulder-joint is more often wounded than the right, " doubtless due," as pointed out by Otis, " to the exposed position of the left shoulder in firing."[1] Associated with the joint injury, there is often fracture of the scapula or clavicle; damage to the important structures in the axilla, or to the chest walls; and, very occasionally, wound of the chest cavity—a lesion of great danger, which patients rarely survive. At times, the ball penetrates without perforating the head of the humerus (Fig. 259), such cases of lodgment being decidedly graver than those in which the shot has passed through.

Fig. 259.

Musket ball impacted in head of left humerus. (A. M. M., Spec. 2696.)

PROGNOSIS.—The *prognosis* of a shoulder wound, like that of any other, will depend upon the nature of the injury; the size, weight, and velocity of the missile; the presence or absence of complications; the health of the patient when wounded; his subsequent hygienic surroundings; and the treatment adopted; but, speaking generally, it may be said that one-third of the cases will die from blood-poisoning, from hemorrhage, or from the effects of protracted suppuration.

TREATMENT.—Leaving out of consideration cases of such extensive destruction of the overlying soft parts, or crushing of the bones (produced ordinarily by cannon shot), as compels immediate amputation, and those of non-penetrating injuries in which evidently no operative interference is required, the *treatment* of shoulder wounds consists in either amputation, excision, or expectancy.

AMPUTATION.—*Primary* amputation is indicated only when, in addition to the joint lesion, there is either extensive shattering of the humerus, through and beyond its upper third, or laceration of the axillary vessels and nerves; and even in these cases, the experience of surgeons during the wars of the last twenty years has shown that the other plans of treatment may very often be advantageously substituted. Though early removal of the limb may be expected to be recovered from in three out of four, if not in four out of five of the cases operated upon, yet there is incurred during the period of treatment a very decided risk of serious secondary hemorrhage; and the patient, at the best, must go through life with what is, functionally, the severest of mutilations, the loss of a whole upper extremity. An *intermediary* disarticulation should never be practised, unless rendered absolutely necessary by the occurrence of gangrene, of acute osteo-myelitis, or of otherwise uncontrollable secondary hemorrhage; the mortality of such operations is nearly or quite twice as great as that of primary, and almost double that of secondary, shoulder amputation. *Secondary* removal of the limb may be required on account

[1] Harlan writes : " The rule seems proved by the exception, that in cavalry the reverse is the case, as far as I have seen. The right being the sword arm, is, of course, advanced in a charge, as well as in the use of the pistol."

of extensive bone-disease, whether or not there has been previous excision, but rarely for any other cause in cases of wound of the joint or upper third of the shaft.[1] The particular way in which the operation shall be performed, whether by the flap or the ovoid method, will depend upon the character of the injury and the preferences of the operator. For such cases as are commonly met with in civil life, other than those in which a charge of small shot, fired at close range, has torn through the axilla as well as the joint, or the bone just below it, amputation is not to be thought of.

EXCISION.—Very much to be preferred to removal of the limb, is removal of the damaged part. Though the mortality of shoulder-joint excision is somewhat higher (5 to 10 per cent.) than that of amputation, yet the preservation of the arm, especially of the right arm, even though an apparatus must be worn in order to permit its being of much use, is of great importance to the patient, and well worth the additional risk incurred. In an uncomplicated fracture, in which the humerus is not splintered below the line of junction of its middle and upper thirds, or for not more than four inches, excision, if recovered from, may be expected to result in the securing of an useful arm. Even more than this amount of the bone may at times be taken away and the patient do excellently well,[2] though Gurlt states that of fifteen cases in which more than four inches was removed, twelve had arms the functional value of which was far from good. The partial regeneration of bone which sometimes takes place improves correspondingly the usefulness of the arm.

In a case reported by Chipault, seven months after a secondary excision of five and a half inches, there had been a regeneration of two inches of the shaft, of diameter almost equal to that of the original bone ; and the patient was ultimately able to carry the arm four inches away from the body, and to place the hand on the top of the head, the arm shortening, and muscular thickening below the shoulder occurring.

Associated injury of the scapula or clavicle, or both, does not render exsection improper : if there is simple fissuring of these bones, operative interference, as far as they are concerned, is not required ; but if there is comminution, the broken parts should be taken away. Of forty-two removals, during our war, of the head, or head and shaft, of the humerus, with portions of either scapula or clavicle, or both, thirty-one recovered, only ten per cent. of the primary cases resulting fatally. From the Servian War, five such cases are reported with one death (20 per cent.), all operated upon after the close of the early period.

In nearly one-half of the cases that recover, a very useful limb remains,[3]

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[1] The percentages of mortality of shoulder-joint amputations during our late war were: *primary*, 24.1 (485 cases, 117 deaths); *intermediary*, 45.8 (157 cases, 72 deaths); *secondary*, 28.7 (66 cases, 19 deaths); and of *unspecified date*, 25.5 (110 cases, 28 deaths). In the French army in the Crimean war, the average mortality was 65.21 per cent., and Legouest has placed it in general at 59.5 per cent. It should be always borne in mind that disarticulation is adopted in very many cases for causes other than those connected with the joint itself, and that the mortality must be proportionally affected.

[2] In a case reported in the "Medical and Surgical History of the War of the Rebellion," the head and *six inches* were removed, and twelve years afterwards, the patient could, without difficulty, place his hand on the top of his head ; and could, without pain, lift a weight of two hundred pounds, or more, with the injured limb. The movements of the forearm and hand were not in the least impaired, and there was great freedom of all the movements of the arm, except abduction. The muscular development of the arm equalled that of its fellow. No apparatus was requisite, and altogether the result was most satisfactory and successful.

[3] Gurlt (whose great work on "Joint Resections" has been, and will hereafter be, freely drawn upon) states that of 213 shoulder excisions, 94 (44.13 per cent.) afforded useful limbs, while 119 (55.86 per cent.) gave arms the functional value of which was not satisfactory, and which could be well used, if at all, only with some applied apparatus. Under the head of useful limbs, are classed, besides the rarely met with cases in which there is ability to execute all the normal movements of the shoulder—even to vertical elevation of the arm—those in

becoming more so in progress of time; and in the great majority of the remainder, by the aid of proper apparatus, the patient is able to write, feed himself, carry burdens, etc. An immovable shoulder joint seldom results—in less than ten per cent. (9.85) of the cases. In more than one-third of the preserved arms, there is no material shortening, and in the rest, such shortening (which is functionally better than the lengthening that is occasionally met with) tends to become progressively of less importance, the upper end of the humerus being gradually drawn up towards the glenoid cavity and the range of movement increased. The atrophy, which is so commonly seen soon after the wounds have healed, is largely from disuse, and diminishes as the arm is employed.

The operation is, as a rule, most readily accomplished by means of the straight incision, no special attention being paid to the location of the bullet wound, the presence of one on the posterior surface of the limb being really of advantage, as facilitating drainage. The ultimate result does not seem to be materially affected by the operative procedure adopted, but does in large measure depend upon the time at which it is resorted to; a *primary* excision, according to Otis's tables, has a percentage mortality of 24.1; an *intermediary* excision one of 45.8, and a *secondary* excision one of 28.7. Gurlt, in his table, which includes nearly 600 (568) additional cases from the German wars, and in which the number of American late excisions is increased by 160 cases carried forward from the intermediaries, gives the percentage of mortality as 31.83 for the primary, 53.12 for the intermediary, and 39.25 for the secondary operations. Either set of figures proves that, at the shoulder-joint, primary excisions are decidedly the best, and intermediary very much the worst, as far as the preservation of life is concerned, though, as respects "end-results," the later operations give decidedly the larger percentage of useful limbs (45 as against 35). When circumstances permit, and it is evident that the operation will be sooner or later necessary, it should be done on the field at once, or, in civil life, as soon as the patient comes under care, if the existing shock is not too great; late excisions should be reserved for cases of necrosis.

Fig. 260.   Fig. 261.
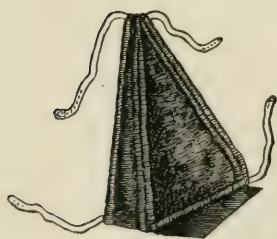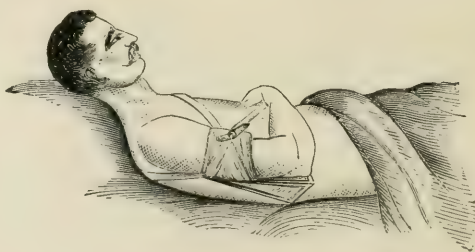
Stromeyer's cushion. (Mac Cormac.)   Application of Stromeyer's cushion. (Mac Cormac.)

In the *after-treatment* of these exsections, great care must be taken to prevent or quickly relieve any undue constriction, which can so readily be caused in this region by a retentive dressing. Many have advised that the arm should be simply placed on a pillow, or a Stromeyer cushion,[1] and that all

which there is complete functional integrity of the elbow, wrist, and finger joints, with power of elevation to a right angle with the body. Mr. Holmes's statement that "the arm can never, as it seems, be elevated beyond the horizontal line" is certainly, while true in the main, not absolutely correct.

[1] This cushion, which the distinguished surgeon whose name it bears considered the "most valuable appliance he had invented during his life," "may be described as a right-angled

attention should be directed to the controlling of inflammation, while others have used a bracketed splint; but very satisfactory immobilization can be made by the application of a plaster-of-Paris roller, up and down over the external and posterior surfaces of the arm, extending it above and below so as to fix the scapula and forearm; with this form of dressing, strangulation cannot take place. What would be, in large numbers of cases, the results under antiseptic treatment, is, at present, a matter of inference. Reyher, at Kars, lost three out of eleven cases (27.27 per cent.), but of his five primary cases treated antiseptically from the beginning, none died, the three deaths occurring among the six patients who were not at once brought under the influence of antiseptics, and who were operated upon in the intermediary or secondary period. From such a limited number of operations, of course, no general conclusions can be drawn as to the value of the antiseptic method and the necessity of its adoption. With as much or more propriety, the English Crimean statistics might be held to show that the success of shoulder excisions is greater when antiseptics are *not* employed, since of eight primary operations recorded during the second period of that war, only one died (12 per cent.), and of five secondary operations, none—being a total of thirteen cases with only one death, a mortality of but 7.7 per cent.

EXPECTANT TREATMENT.—From the earliest times, there have been reported occasional recoveries from shoulder wounds in which no operative interference was employed. Much attention has been lately directed to such treatment by "expectancy," and the opinion has been held by many experienced surgeons, especially among the Germans, that it is quite as likely to be followed by recovery as either excision or amputation; and some have even gone so far as to declare that the "end-result" is a better one, the limb being more useful. Statistically, it would appear from Otis's investigations that the death-rate may be placed at about one-third;[1] but the value of such a statement, in determining the acceptance or rejection of this plan of treatment, is very much lessened when it is remembered that, as a rule, it has been adopted only for the less severe injuries.

"An attempt to establish direct numerical comparisons between the results of expectant treatment, excisions, and amputations, after shot fractures of the shoulder, would probably be undertaken only by some sciolist or dabbler in statistics, since the injuries involved are so variable in nature and extent, that the terms of comparison cannot be fairly ascertained, and any strict application of the numerical method is impracticable." (Otis.)

In civil life, in which the wounds are almost always produced by missiles which are smaller, and which move with less velocity, than those causing the lesions met with in time of war, the expectant plan may be adopted with greater prospect of success; but even in cases of small-ball fractures, there is much danger of the occurrence of secondary hemorrhage, or of the development of general septic infection. Associated fracture of the scapula or clavicle, or both, if not very extensive, will not contra-indicate the adoption of a conservative course of treatment; and in the somewhat rare cases of joint injury

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isosceles triangle, four inches thick at the apex, which rests against the chest and supports the elbow, the forearm being bent at a right angle with the arm. The cushion gradually thins down till the base is a mere edge, and of the two other angles, one is passed up into the axilla, while the other rests on the chest under the wrist. The cushion is readily fastened in its place by a tape round the neck, and one round the body." (Mac Cormac.)

[1] In our war there were 505 cases with 139 deaths, or 27.52 per cent.; collected from various European writers on military Surgery, 185 cases with 90 deaths, or 49.73 per cent.; total, 690 cases with 229 deaths, or 33.18 per cent.

without osseous lesion, it is of course the method that should be at first selected.[1]

Even if after some weeks exsection should be rendered necessary, the result, it would appear from the statistics previously given, would not be in any great degree worse than if it had been primarily resorted to. Unfortunately, however, during the period in which, if it can possibly be avoided, no operative interference should be allowed, a considerable percentage of the more seriously injured patients who have been expectantly treated, die, while many of them doubtless might have recovered had an early operation been practised. But as amputation, as the result of extended experience, gave place to excision as the proper measure to be adopted in the graver cases of shoulder wound, so future observation may lead to the substitution, for either, of the skilful aiding of nature in her efforts at restoration. Such a report as that of Beck's, who saved twenty-six out of twenty-eight cases (one dying of tetanus, the other coming under treatment only when in such bad condition as to be no longer a proper subject for any operation), is certainly very encouraging; particularly so if, by the adoption of an antiseptic course, early healing can be secured and wound infection prevented, in considerable part, if not wholly. When expectancy is tried, the ordinary measures for the maintenance of rest of the part and of the fragments, and for the securing of thorough drainage, must be adopted here as everywhere else. As Beck has written:—

By absolute rest, appropriate position, and corresponding bandages; by immobility; by constant application of cold; by an antiphlogistic regimen; by incisions (extended, in cases of severe tension of the capsule with threatening suppuration, even into the synovial sac, for the purpose of allowing the accumulated fluids to escape); by well timed opening of burrowing abscesses; by extraction of loose splinters or fragments; by the administration of opium; by subcutaneous injection of morphia in case of severe pain—the course of the injury may frequently be controlled, and even a cure with usefulness of the limb, though comparatively limited, may be accomplished.

Anchylosis may be expected to take place when the comminution and the necessary removal of fragments have not been very extensive, but freedom of movement of the scapula much lessens the resulting impairment of the functions of the arm. Stiffness of the joint, in greater or less degree, will almost certainly attend the cure; and even in many of the peri-articular injuries, false anchylosis from contracted cicatricial bands will occur.

GUNSHOT INJURIES OF THE ELBOW.

Like those of the shoulder, wounds of the *elbow-joint* may be either accompanied or unaccompanied with fracture; and in cases of the former kind, which are by far the more numerous, all the bones of the articulation may be injured, or only some of them. Peri-articular wounds and contusions commonly cause very decided synovial inflammation, but it becomes suppurative only after opening of the membrane by ulceration, by gangrene, or by injudicious surgery. Cicatricial contraction and muscular shortening usually cause more or less false anchylosis; and nerve lesions, primary or inflammatory, may lead to the development of neuralgia, and may contribute in no small degree to the production of the commonly occurring muscular atrophy, which is due in part also to disuse. A severe contusion, because of both its immediate

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[1] Among the 84,000 and more gunshot wounds of the upper extremity reported during our war, there were 225 cases of joint wound without fracture 72 of these being of the shoulder; of these 6 died, or $8\frac{1}{3}$ per cent.

and its ultimate effects, is certainly a graver lesion than such a perforation as is met with in the majority of cases. Though usually the diagnosis of penetration is readily made, it is at times very difficult, or even impossible, to ascertain positively that the joint has been opened, without such an exploration as it would be improper to make. The *prognosis* of elbow shot-wounds is not specially grave, as far as life is concerned, the mortality being only about 20 per cent.; but as respects the functional value of the limb, it is far otherwise. Here, again, three methods of *treatment* are to be selected from, amputation, excision, and expectancy.

AMPUTATION, as a primary operation, is clearly and unquestionably indicated only when there has been great destruction of the part by impact of a

Fig. 262.

Shot perforation of right humerus at lower third. (A. M. M., Spec. 4109.)

large projectile; or when, in addition to the fracture, there has been laceration of the brachial artery and the radial and median nerves, an ulnar-nerve wound being of comparatively little importance. When the artery only has been injured in connection with fracture of the humerus, surgeons generally are agreed upon the advisability of amputation; but some, such as Legouest, do not regard the operation as "always indispensable." The correctness of this opinion is still to be proved. "Löffler's assertion that surgical literature has not presented an example of recovery [with preservation of the limb] from shot fracture of the humerus with division of the brachial, remains uncontradicted." (Otis.)[1] Again, when there has been extensive comminution of the humerus produced by a bullet, and the splintering extends so far up into the shaft that the broken portion cannot be taken away with a reasonable prospect of preserving an useful arm, the limb should be removed; since an attempt to save it will very probably end in the patient's death from septic infection, or in disarticulation at the shoulder at a time when the individual is in very poor condition for any operative interference. In all other elbow-wounds, the choice lies between excision and expectant treatment.

EXCISION OF THE ELBOW, from which in cases of gunshot injury so much was expected a quarter of a century or more ago, has certainly in large measure failed to accomplish what is desired, the preservation both of life and of a serviceable limb. Practised in any of the ways adopted in cases of disease, but generally by the straight posterior incision, it may be either *complete* or *partial*, all the articulating surfaces being removed, or only those which are actually damaged. It has been generally believed that a complete was decidedly preferable to a partial excision, being attended with less risk, and giving a better result as regards the usefulness of the preserved limb. Such was Otis's opinion, and yet it would appear that the mortality in our war was 2 per cent. greater, and, taking together the four German wars and our own, 2⅓ per cent. greater when the whole joint was excised than when only a part of it was removed (22.91 as against 25 per cent.; 23.07 as against 25.50 per cent.). The percentage of good "end-results" was, however, 2.25 in favor of the complete operation. *Primary* excisions have resulted fatally in 21.59 per cent. of cases (84 out of 393), a mortality decidedly less than that of the *intermediary* (29.26 per cent.), and that of the *secondary* (28.48 per

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[1] In the very remarkable case under the care of Dr. T. Curtis Smith, in which the joint was extensively fractured with laceration of the brachial artery, the upper part of both ulnar and radial arteries, and the ulnar and median nerves, the articulating extremity of the humerus was laid bare but not broken. Excision was in this case successfully resorted to.

cent.), though the death-rate of a few (14) *late* operations (which were, un-doubtedly, practically for disease, and not for injury) was zero.

In our war, immediate exsection was slightly more dangerous (1 per cent.) than primary amputation in the lower third of the arm, and very much more so (8.1 per cent.) than removal in the upper third, though nearly 3 per cent. less fatal than that operation when required by elbow-wounds. After exten-sive investigation, Dr. Otis was compelled to write: "Although the point is open to argument, I fear that the substitution of this resection for amputa-tion effected no saving of life;" and the average mortality of the more recent operations during the Franco-German war was even greater than that pre-sented in Dr. Otis's Surgical History.

EXPECTANCY.—In the cases treated by expectation during our late war, 938 in number, death resulted in but 10.3 per cent. (96). This statistical state-ment is, however, of little value in determining the proper method of treating elbow fractures, since it was only in the less serious cases that no operation was employed; had it not been so, American surgery would have proved be-yond question the superiority of expectancy. As it is, there has been for years past a growing feeling in favor of this method, when removal of the arm is not evidently necessary, and a conviction, as Lücke has said, that " a large proportion of shot injuries of the elbow-joint may be treated conserva-tively, that is, without any operation whatever." Of seventy-seven cases under the care of eighteen surgeons, during the war of 1870–1, only six died (8.6 per cent.). That a successful result may be secured, if " Listerism" is not carried out, there must be removal of all detached splinters, thorough drainage of the joint-cavity, immobilization of the limb (which may be well effected by using an Esmarch's bracketed splint (Fig. 263) having an elbow angle

Fig. 263.
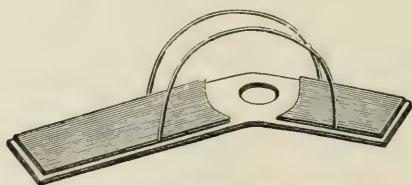
Esmarch's bracketed elbow splint.

of 130°), and moderation of inflammation. The free laying open of the joint, which has by some been recommended as a measure of prevention, should not be resorted to, unless necessary for the securing of a ready outflow of pus.

If life is saved, and secondary excision or amputation does not have to be adopted—and one of these has unfortunately heretofore been required in a large number of cases, perhaps a third of all those treated by expectation—what is the after condition of the limb, and how does its usefulness compare with that of one in which there has been a primary exsection? Very seldom has recovery taken place with preservation of the motions of the joint, and not very often with no other functional impairment than anchylosis in good position. Even though flexion and extension are lost, pronation and supina-tion may remain, if the radius is uninjured and if only one of the other bones has been broken. Muscular atrophy follows, sometimes in high degree, and there may be persistent neuralgia. As a rule having not very many excep-tions, the arm that remains after gunshot wound of the elbow which has been treated expectantly, is functionally a much damaged one.

How is it after excision—an operation which in civil life, and when per-

formed for disease, succeeds admirably? In nearly one-half of Gurlt's cases (45 per cent.), the individuals were, years later, altogether unable to support themselves. In only three out of every ten (104 out of 355), could active movements be fairly well made, and could the other joints, particularly those of the fingers, be said to be in perfect condition. In more than seven out of every ten (251 out of 355), there was either a "dangle-joint," or such a fixed twist of the arm that the usefulness of the hand was greatly impaired, or an anchylosis at a very obtuse angle (189); or muscular paralysis, or deformity and stiffness of the other joints, especially of the hand (51); or such persistent pain as to make the arm worse than useless (11). Of the primary excisions, only one in five was followed by a favorable result, and of the secondary, only three in ten; while of the very late operations, which much resemble those for disease, more than one-half ended well.

Anchylosis, which is, of course, much more likely to follow partial than complete excision, if it is uncomplicated and takes place at a good angle (from 90° to 130°), leaves a very useful arm. Through fear of an exceedingly loose joint, many, especially of the Continental surgeons, have directed their efforts to the securing of an immovable elbow; and of the two conditions of the part, the latter, if the forearm and arm are relatively properly placed, is much the better. But in more than half of Gurlt's cases of movable joint, there was no flail-like condition; and in many of the anchylosed limbs, if passive motion had been instituted as soon as suppuration became much lessened, or as soon as it could be employed without the patient experiencing much pain, and had it been kept up long after cicatrization was completed, there can be no question but that a very valuable, movable joint would have been secured, and muscular atrophy largely prevented. This atrophy, which especially affects the muscles of the arm, and of these the triceps most extensively, depends, in part at least, upon disuse; and, if in the operation the muscular insertions have been respected, by beginning passive motion as soon as it can be safely permitted, and by allowing active motion as early as it can be made, the wasting will certainly be in no small degree controlled. Expectation results badly; so does exsection. Nothing but future observation, on a large scale, can determine which is the preferable mode of treatment. What shall be done with gunshot wounds of the elbow, is one of the vexed questions which will demand consideration in the next great war, wherever it may be waged.

Gunshot Injuries of the Wrist.

Gunshot wounds of the *wrist*, decidedly more frequent on the left than on the right side, are almost always attended with fracture; are much more dangerous, as far as the part itself is concerned, when the ball has passed from side to side than when it has gone through the antero-posterior diameter of the joint, and are frequently associated with extensive injury to the lower end of the radius or ulna, or both, and often with severe damage to the second row of carpal bones and to the metacarpus. Great destruction of the joint and of the lower part of the forearm necessitates in military, though not so certainly in civil practice, *amputation;* an operation attended with a mortality of about ten per cent. (9.6 per cent. in the 1007 primary cases during our war). In wounds of lesser severity, the treatment may be either by *expectancy* or by *excision;* the former method, according to Otis's tables, resulted fatally in 7.6 per cent., and the latter in 13.2 per cent., of the cases in which they were respectively adopted, though there were numerous cases " treated at the outset by expectation, in which excision or amputation was

eventually resorted to, with an excessive rate of mortality; . . . and consequently the results of the conservative, expectant plan are represented in a too favorable light."

An injury of this articulation, because of the anatomical structure of the damaged region, is almost certain to be followed by inflammation of high grade, attended by great pain, and extending through and beyond the carpus, unless tension is prevented or very promptly relieved. Suppurative synovitis of the tendon sheaths, which is so apt to occur, may be expected to give rise to destructive inflammation of the connective tissue planes of the forearm, and of the like tissue in the palmar subfascial bursa, unless judicious treatment be adopted, and not seldom will do so in spite of treatment. If no operative interference be required, the use of the usual remedial measures already referred to in connection with joint-injuries in general—rest, cold, position, etc.—must be thoroughly carried out. Much suppuration and delay in healing may often be prevented, and the chances of recovery correspondingly increased, by at once removing carpal bones which have been extensively shattered. Such an operation can hardly be considered a formal excision, although cases thus treated have been so included by some authors. At most it is but an excision *in*, not *of*, the articulation.

Primary hemorrhage from one of the large vessels is not a bar to the adoption of conservatism, as it may be controlled by the application of a ligature; and secondary bleeding, which at times occurs, may generally be arrested in the same way. Anchylosis of the wrist takes place in the great majority of cases which recover, but it is a matter of comparatively little importance if the finger motions have been preserved. Every care should be taken, by the selection of position and by moderation of inflammation, to prevent adhesion of the flexor and extensor tendons to their sheaths; and early but judicious, passive, and at a later period active, motion should be made, in order to preserve, if possible, the finger movements, without which any saved hand is of little functional value. When formal excision is adopted, it should be by lateral incisions, as in the method of Lister, or by the dorso-radial, straight incision of Langenbeck; the cut across the dorsum is proper only when the missile has already divided the tendons. The lower part of either radius or ulna alone should not be removed, since after recovery the hand is almost certain to be deflected laterally, at times

Fig. 264.   Fig. 265.
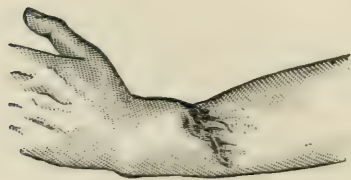
Deformity following removal of fragments from comminuted gunshot fracture of radius. (A. M. M. Spec. 2671.)

Deformity following excision of lower portion of radius. (McDermott.)

even to a right angle (see Figs. 264, 265); if only one of the two bones is damaged, the lower end of the other should be equally exsected, in order that a straight position of the hand may be secured. Decided advantage

has been found to result from continuous extension by adhesive straps and weights, the forearm being maintained in a somewhat supinated position.

In nearly one-tenth of Gurlt's cases (9.6 per cent., 12 out of 125) amputation was ultimately required; and one-half of those thus operated upon died. The death-rate of all the resections was 16 per cent. (20 out of 125), pyæmia being, as in the cases treated. by expectation, the chief cause of mortality. As respects saving of life, removals of the radius and carpal bones have given the best results, all of the eight cases recorded having ended in recovery; and removals of the lower ends of the bones of the forearm with the carpal and metacarpal bones have given the worst, two out of the five persons thus operated on having died (40 per cent.). When the wrist-bones in part or whole are taken away, there is, it would seem, a most marked difference in the death-rate according as the ulna is or is not removed, the percentage being in the former case from 20 to 40, varying with the bones removed. Whether or not this has been in the observed cases simply accidental, or really consequent upon the removal of the ulna, future experience must determine; it may perhaps be a significant fact that, when only the lower end of the ulna has been exsected, the fatality has been more than twice that of similar operations upon the radius (19.23 per cent.; 8.1 per cent.).

Although, as has been shown, the average mortality of wrist-wounds treated by excision is double that following expectancy, yet, as cases of the latter class are, as a rule, of decidedly less gravity than those of the former, the real question to be settled is which gives the best ultimate result. That of expectation is certainly not satisfactory, as far as the functional value of the saved hand is concerned; anchylosis, deformity, more or less stiffening of the fingers—such is the condition reported as existing in the great majority of cases; but, on the other hand, the same is true of excision:—

"In sixty-eight of the ninety-six patients whose hands were preserved, at least in part, fifty-one had anchylosis at the wrist, five mobility with deformity, and three dangling-joints. Nine, of whom two are still in service, are reported to have had comparatively useful limbs." (Otis.)

Gurlt says that of the 72 American cases which he has tabulated, in only three were the results in "any way good;" and that of the sixteen German patients, but one had a good arm and hand, while in eight cases the parts were but tolerably useful, in six they were bad, and in one worse than useless. As a whole, the results were "very unfavorable." It would certainly seem that the proper treatment of wounded wrist-joints, when there is not such complete smashing as to compel immediate amputation, is by expectation—that is, by removing fragments, immobilizing the forearm and hand, securing drainage, moderating inflammation, opening abscesses, employing antiseptics, and, as far as possible, preventing stiffening of the fingers—and not by formal exsection, either complete or partial.

GUNSHOT INJURIES OF THE HIP.

Of much greater severity than those of the corresponding joints of the upper extremity, are gunshot wounds of the hip, knee, and ankle. Injuries of the *hip-joint* may be either penetrating or non-penetrating. The overlying soft parts may be simply contused, or the ball in its passage across it may bruise the capsule, or there may be a wound of the femur with splintering up to, but not into, the intra-capsular portion of the neck. In all of these latter conditions, when there is subsequent involvement of the joint itself, synovial inflammation takes place—frequently, but by no means always,

suppurative in character—with, ordinarily, rupture of the capsule at a later period, burrowing of pus, and, if death does not previously occur, formation of sinuses. Caries at times is developed, or a condition of the head and neck of the bone similar to that observed in chronic rheumatoid arthritis. In the penetrating wounds, there may be perforation or lodgment of the ball; limited or extensive shattering,[1] the fissures running, it may be, through the trochanters, or far down the shaft; fracture of the acetabulum or other part of the innominate bone, or penetration of the pelvic cavity with or without visceral lesion; wound of the neighboring great vessels or nerves; or associated through distant injury of, at times, the same extremity.

Fig. 266.

Upper end of left femur perforated by conoidal ball. (A. M. M., Spec. 565.)

DIAGNOSIS AND PROGNOSIS.—Difficult as is often the diagnosis of a wound of any joint, it is especially so in the case of the hip, positive evidence in the escape of synovia, digital exploration, or the severity and character of the after-symptoms, alone sufficing to establish it. The left hip is much more often wounded than the right, no doubt because of its more advanced and exposed position in firing. The mortality of these wounds is excessive. Of 349 which occurred during our war, 297 died (85 per cent.); and in all probability, were the cases of recovery in which a mistake was made in diagnosis (no penetration having taken place) eliminated, the death-rate would be found to be nearly or quite 95 per cent., the fatal issue being due in most instances to shock, visceral wound, exhaustion, or septic infection.

TREATMENT.—Expectancy, excision, and disarticulation, are all but doubtful remedies for a desperate condition. Hip-joint *amputation* (which should be employed, if at all, only when there has been great destruction of the part, or wound of the main vessels or nerves, or associated fracture lower down), had prior to 1870 resulted fatally in 29 out of 31 cases in which it had been performed for intracapsular wound, that is, in 93.5 per cent.; and it is probable that in the large majority of these cases, the operation only hastened death.

Excision, first adopted in shot-wounds of the hip but a little more than half a century ago (by Oppenheim, in 1829), and done but twelve times in all up to 1861—two of these operations, moreover, having been at a late period, for caries—has resulted fatally in 90.6 per cent. of the cases in which it has been performed for joint-wound (106 out of 117). But not one of Reyher's three cases antiseptically treated proved fatal, and in the future, the adoption of some method to render the operation wound aseptic, may very materially diminish the mortality. Even if it should not, there can be no question but that the removal of the broken bone and drainage of the cavity greatly contribute to the comfort of the patient, while he does live; and if recovery takes place, it is with a quite useful limb, notwithstanding its being more or less shortened; the result is functionally better under these circumstances than that of similar operations done for disease. All of the 15 individuals successfully treated were able to use the leg more or less perfectly, and to make a living. As the result of a secondary excision done by Surgeon J. R. Gibson,

[1] In a case operated upon by Surgeon Clements, U. S. Army, the cervix femoris was found broken into about forty pieces.

U. S. A., in 1868, the man three years later "could walk almost as well as ever." Dr. Mursick's patient, four and a half years after an intermediary operation, could perform all the movements of the thigh "with almost as much facility as in the normal state—rotation, even, as well as flexion, extension, adduction, and abduction. His general health was good. He still worked as a day laborer."

In the present state of knowledge, it certainly seems the part of wisdom, in cases of hip wound, to make an exploratory incision as soon as possible, and, if the damage has not been such as to preclude any reasonable hope of doing good, to excise the broken bone. No benefit can be derived from leaving, as has been done, an uninjured femoral head in the acetabular cavity, when the neck is taken away; necrosis would certainly follow. Ordinarily, the long, straight or angular incision, from above downwards, along the posterior border of the trochanter major, will be found most convenient. If the patient must be moved, the joint should be immobilized; but if he can be treated at the place of operation, the dressing may be conducted according to any one of the several methods which are employed in civil practice after excision for disease.

Gunshot Injuries of the Knee.

Of more frequent occurrence, and of hardly less gravity, than wounds of the hip, are those of the knee-joint, which may be either penetrating or non-penetrating. The latter undoubtedly occur, oftentimes, when the apparent line of direction of the shot lies through the articulation, the missile having been deflected by the periarticular structures;[1] and the joint proper may not be opened, even though the patella has been broken, or the head of the tibia bored through. Such a tibial perforation, which is not very seldom seen as the effect of a round ball, may be caused by the passage of a pistol bullet, and, though not very often, even by that of a conoidal musket-ball—the chassepot bullet being the only one used in the Franco-German war which produced such an injury in the cases observed by Becher. Usually, whether the shot has passed through or lodged, there is associated fissuring, and, if not primary, at least secondary opening of the synovial pouch, in which case violent symptoms of joint injury may not manifest themselves until several days after the receipt of the wound.[2]

Penetrating injuries, whether made by small or large bullets, are in a high degree dangerous, not only to the part but to life itself, the usual gravity of lesions of the knee-joint being greatly increased by the more extensive damage which is always characteristic of gunshot wounds.

Expectant Treatment.—Until recently, the expectant treatment has resulted badly, except when the vulnerating body has been of small size, its removal easily effected, and the bone-splintering limited; and when circumstances have permitted of most judicious care under favorable personal and hygienic conditions. "In no single instance during the Crimean war" (ac-

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[1] MacCormac reports that he had under his care, during the Franco-German war, twenty-one such cases, of which only two proved fatal.

[2] A typical case, in which a soldier was accidentally shot with a small revolver-ball in the street of Balaklava, was reported from the Crimea. "The missile had embedded itself in the tibia, just below its tuberosity, whence it was easily turned out by a pointed instrument, after a small incision had laid the site open. The knee-joint did not appear to have been involved, but the man died eight days afterwards from the effects of acute inflammation of it, and the accompanying sympathetic fever. On examination after death, a minute fissure was found to have extended through the head of the tibia into the joint." (Matthew.)

cording to Longmore), "was a knee-joint, which had been opened by a bullet, saved, life being lost in every case where amputation was not resorted to." By the official "Medical and Surgical History of the British Army" in the Crimea, however, it is shown that eight cases were saved without operation,

Fig. 267.   Fig. 268.

Partial fracture of left femur by conoidal ball lodged in cancellated structure. (A. M. M., Spec. 4071.)

Amputated end of right femur and head of tibia with round musket ball impacted in latter. (A. M. M., Spec. 1481.)

though in none of them was the bone within the capsule "more than grazed (not fractured)." Of 308 cases treated by expectancy during our war, 258 (83.76 per cent.) died, and it is believed that even this does not truly represent the excessive mortality, cases of non-penetrating wound probably having been, by error of diagnosis, included among the 50 that recovered. Of 529 cases similarly treated in the Franco-German war (and reported upon by Heintzel), 334 (63.14 per cent.) died—225 of these after subsequent amputation, which was employed in 288 cases, or in 54.4 per cent. of the whole number which it was attempted to treat expectantly. Of the entire 529 cases, only 132 (25 per cent.) recovered with a fairly useful limb. Of Reyher's 19 cases, 18 died (94.7 per cent.). On the other hand, during the war of 1866, out of eighteen cases of gunshot wound of the knee, eleven were cured by conservative treatment (61.11 per cent.). Extensive opening of the joint by a shell fragment is more likely to be followed by recovery than is a bullet wound. Such injuries, if not fatal, are usually followed by anchylosis.

AMPUTATION AND EXCISION.—Until within the last ten years, the results following *amputation* were better than those obtained by expectation, but the mortality rate was still very high, especially when the operation was performed in the intermediary period. Of 452 determined cases, during the war of the Rebellion, 331 died, or 73.23 per cent. *Excision* of the knee, which has been adopted 134 times in military practice, has been followed by death in 108 cases, or 80 per cent., and unless the antiseptic treatment should in the future very greatly lessen this mortality, the operation should certainly be, as Sarazin has put it, "proscribed in army surgery." In civil life, it succeeds much better, as might naturally be expected, since the injuries are as a rule less extensive, being made by smaller projectiles, and since the after-

treatment can be more satisfactorily carried out. Of twelve such cases, tabulated by Gurlt, only three died (25 per cent.). It would appear from the investigations of the writer just quoted (though his conclusions are based upon only 28 cases), that if the patient does not die, he will probably recover with an useful limb—the "end-result" of this excision being better than that of any other except the hip.

But while, prior to 1876, under any one of the three methods of treatment, gunshot wounds of the knee, in time of war, resulted fatally in more than two-thirds of the cases, the reports that have been given of the recent attempts at conservation, under antiseptic treatment, would seem to indicate that the mortality can be very much lessened. Of Reyher's eighteen cases, antiseptically treated from · the first, only three died (16.66 per cent.), and twelve of these which were treated by occlusion, all recovered, each with a movable joint. Of his 40 cases which were only secondarily rendered antiseptic, 34 died (85 per cent.). Of Bergmann's fifteen cases treated early, but one died (6.66 per cent.); of his fifty-nine cases in all, only 24 died (44.5 per cent.); and of the thirty that recovered, twenty-eight preserved their limbs.[1] Of four non-military cases treated at Halle, all got well, and in three there was good motion of the knee (Kraske).

Fig. 269.

Diagram of gunshot wound of tibia with fissure entering knee-joint. (Kraske.)

Even very considerable splintering has not prevented rapid recovery with preservation of the function of the joint. Unless future and extended experience shall show that such favorable results are but exceptional, knee-joint wounds hereafter must be treated conservatively and antiseptically, if the extent of the injury be not so great as to necessitate immediate amputation; for it would certainly seem as if Reyher was right in declaring that "under primary antiseptic treatment, the injury loses its danger for life and limb of the patient. The prognosis is better, and to this must be added the assurance with which a prognosis can be made."

GUNSHOT INJURIES OF THE ANKLE.

As in wounds of the other joints, so in those of the ankle, the articulation may or may not be opened. The periarticular injuries, which usually involve the parts behind the joint—seldom those in front—not infrequently cause severe hemorrhage, primary or secondary; may be associated with lesion of the posterior tibial nerve; and are often followed by stiffness of the ankle from cicatricial contractions, and by deviations of the foot from shortening of tendons, the result of loss of substance or of inflammatory adhesions. The

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[1] Bergmann's dressing was from necessity quite a simple one : "As soon as possible after the wound had been inflicted, the vicinity of the spot where the shot had penetrated was cleansed, then the whole limb was wrapped in a thick layer of antiseptic cotton-wool, the latter firmly pressed down by means of an elastic bandage, and the whole, including the ankle and hip-joint, embedded in plaster of Paris, and allowed to remain undisturbed for a fortnight or more. In some cases the first application of this dressing sufficed to effect the healing of the cutaneous wound."

penetrating wounds are much more frequently caused by the passage of a ball laterally than in the antero-posterior diameter, so that malleolar fracture is commonly seen either on one or both sides, and, if only one, generally on the outer. Escape of synovia in moderate amount, without other associated evidence, cannot be held to certainly indicate opening of the articulation, since wounds of the sheaths of the tendons may be followed by a similar discharge.

TREATMENT.—The treatment of these ankle-wounds must be conducted upon the same general principles as those already considered in connection with injuries of the wrist, the analogous joint of the upper extremity. When the destruction has been great, as from a large shell fragment in military life, or from a load of shot at short range in civil practice, even if one of the main vessels and nerves be undamaged, amputation may very properly be performed, since the danger of the operation to life will be at least no more, while recovery will be quicker—and by the adaptation of an artificial foot the functional value of the limb will be fully as great, if not greater—than when conservative measures have been successfully adopted. Under all other circumstances, every effort should be made to preserve the foot, the usual details of the treatment by *expectancy* being fully carried out. Not only should all foreign bodies be removed, but the gouge may be freely used along the shot track through the bone or bones, and if necessary for the proper drainage of the wound, a malleolus may be cut away. Extensive destruction of the tendo-Achillis does not, as has by many been thought, contra-indicate the attempt to save. In the immobilization of the part, much care must be taken to keep the foot at a right angle to the leg, to prevent the production of the "pointed toe" that so much interferes with the after-usefulness of the limb; and suppurative teno-synovitis, which is very likely to occur, must, if possible, be prevented. Almost certainly, anchylosis will take place, and such a termination is really the most desirable. But recovery in the great majority of cases of penetration, certainly of those treated otherwise than antiseptically, takes place only after the lapse of many weeks, and the results of the protracted confinement and suppuration may be such as to compel the performance of either excision or late amputation.

Primary excision has been very rarely if ever performed for gunshot injury of the ankle, so that in this joint excision may be regarded simply as the complement of expectancy. Its results have not been such as to make it a favorite operation with military surgeons. Of the 142 cases tabulated by Gurlt, 49 ended fatally (35.5 per cent.), and in 19 cases an after-amputation was required, with a resulting mortality of 63.15 per cent. Death, according to Culbertson, may in one-sixth of the cases be attributed directly to the operation itself. Of the patients who recover, about one-half (52.72 per cent. of the 55 Germans in whom Gurlt was able to ascertain the "end-result") may be expected to have a fairly useful limb, and this whether the resection be complete or partial. If only one of the leg bones has been involved in the excision, lateral deviation of the foot will almost certainly take place. The operation, if done at all, should be effected by means of lateral incisions. The duration of treatment in successful cases is to be estimated by months, not weeks.

In contrast to the death-rate of excision (35.5 per cent.), that of ankle-joint *amputation* is low (13.43 per cent. in the 67 cases tabulated in "Circular No. 6"); that of supra-malleolar amputation "surprisingly low" (Otis); and that of leg-amputation in general, while quite high—26.02 per cent. (Otis)—still nearly ten per cent. more favorable. Even compared with Legouest's statis-

tics, excision is more dangerous by 12.5 per cent. than amputation at the joint, though less so by 13.5 per cent. than removal through the leg; but Legouest's figures, here as elsewhere, are largely those of the operations performed by the French surgeons in the Crimea, the fatality of which was excessive.

GUNSHOT INJURIES OF THE HEAD.

Gunshot wounds of the head may be confined to the *scalp;* may also involve the *cranial bones;* or may present, in addition, an injury of the *brain* or its coverings, with or without lodgment of the missile.

SCALP.—When the scalp alone is damaged, there may be only *contusion*, which, if severe, is almost certain to be followed by cerebral disturbances; or simple *division*, differing but little from an incised wound, an accident due almost always to the superficial impact of a shot passing at a high rate of speed; or, what usually occurs, a more or less deep *grooving* with primary or secondary loss of substance; or, and this is frequently observed, a *seton wound*, sometimes of considerable length; or, lastly, *penetration with lodgment*, often seen in wounds produced by small shot or pistol bullets of small diameter, and at times in those caused by nearly spent rifle-balls. Ordinarily recognized without difficulty, the scalp injury may, for a time, escape detection when the shot has passed up to the head from the neck or face.

The *prognosis* is favorable; the mortality is only 2 per cent.[1] chiefly from " some form of encephalitis," though the various wound-complications may occur, particularly hemorrhage; and though cerebral disturbances, occasionally very persistent, are not unlikely to follow injuries inflicted by missiles of large size. Primary union seldom occurs, though much more apt to take place here and on the face than in superficial wounds in other parts of the body.

Treatment.—If a bullet has lodged, its presence can be detected without difficulty, except when located in the temporal fossa; its position then may be indicated only by pain on moving the lower jaw. Bird-shot, and even small pistol-balls, may be so flattened and buried in the tissues as not to be discovered upon palpation, or by the use of the probe. If found, the foreign body is to be removed through either the original wound or a counter opening; but when very small, no extensive search should be made, as the offending substance will probably reveal its presence at a later period, or will otherwise remain innocuous, causing no material delay in the healing of the wound. *Seton wounds* not infrequently convert themselves by sloughing into deep *grooves;* and because of the possibility of such a change being produced, some have advised that they should be early laid open, a procedure, however, that, as a rule, should not be adopted, since in very many cases, when let alone, the bullet track readily heals. As the result of a shell wound, there may be an extensive loss of substance, with or without exposure of the bone.

The treatment of scalp wounds is that of ordinary flesh wounds elsewhere, though in cases in which there has been produced scarcely more than an *incision*, sutures may be very advantageously employed, primary union being not infrequently thereby secured; and in the cases of *grooving* the introduction of stitches does no harm, and often by holding the edges closer together lessens the time required for healing. As in scalp-injuries other than gunshot, adhe-

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[1] 162 deaths out of 7739 cases during our war (2.09 per cent.)

sive straps are of little service, since they soon become loosened and slip. Hot applications at times are much more comfortable and better adapted to moderate inflammation than cold.

CRANIAL BONES.—Like other bones, those of the cranium may be either contused or broken; such lesions are, as a rule, more serious than when conse-

Fig. 270.   Fig. 271.
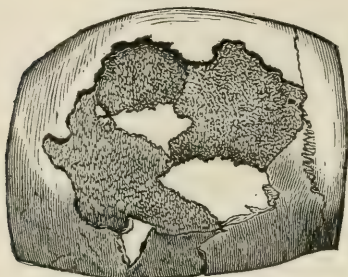
Necrosis following gunshot fracture of right parietal bone. (A. M. M., Sect. 1, Spec. 3859.)
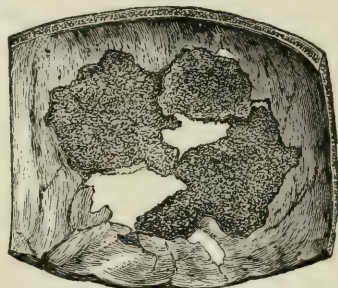
Necrosis following gunshot fracture of right parietal bone. (Interior view.)

quent upon an ordinary blow, or fall, and are more apt to be associated with cerebral injury.

CONTUSION OF CRANIUM.—The contusion may be slight, unrecognized, and quickly recovered from, as it is likely to be when due to a small pistol-ball wound; or may be so severe as to kill at once the injured part; or may be followed by acute or chronic bone inflammation, causing subperiosteal effusion or exudation, suppurative osteo-periostitis, or necrosis—caries is rarely observed—one or all; and complicated with severe inflammation of the overlying soft parts, meningo-encephalitis, cerebral abscess, or pyæmia.[1]

Not infrequently it happens that no symptoms of bone-injury show themselves for many days, when suddenly violent cephalalgia is experienced, soon followed by convulsions, coma, and death from intracranial suppuration. Very generally, however, if primary laceration of the meningeal vessels causing compression from blood-clot has not taken place, there will be experienced, after recovery from the immediate effects of the wound, it may be for a long time, headache of greater or less severity, associated in many cases with dizziness, intolerance of light and sound, nausea, and vomiting. Simple *periostitis* does not often occur, and no case of diffuse inflammation of the pericranium was reported during the whole course of our late war. *Osteo-periostitis* may be indicated by the presence of the "puffy tumor of Pott," which however is by no means always present, and by the exudation of pus through the contused bone. Purulent infection manifests itself in the usual way. At a later period exfoliation occurs, either superficial or of the external table, and, at times, separation of necrosed pieces of the entire thickness of the bone. This *necrosis* is occasionally primary, but is generally consequent upon inflammation. *Hyperostosis* or *eburnation* may, though rarely, be met with.

Chronic cerebral disturbances, more or less well marked, mental irritability,

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[1] The hepatic abscesses observed long ago, without any pus collections in the lungs, are, it is probable, due to the passage of septic emboli (from thrombi in the diploic veins) from the arteries to the veins, in the lung, in which viscus, besides the usual capillary connection, there is also, as observed by O. Weber, a "direct merging of the terminal ramifications of the arteries in the rootlets of the veins."

change in the temper and habits of the individual, and epilepsy, are not rarely found as the result of these injuries. Judging from the cases reported by Otis, one in six of cranial contusions from rifle-bullets and shell-fragments may be expected to cause death;[1] and, speaking generally, these contusions when severe are more serious than fractures, the breaking of the bone in a measure protecting the brain and its coverings, lesion of which is the chief element of danger in all head injuries.

Treatment.—When contusion is known to have occurred, the maintenance of rest is of the utmost importance, and, if symptoms of internal inflammation show themselves, cold should be applied, either by ice-bags or by a coil of rubber tubing (the mediate-irrigation coil of Petitgand). Subperiosteal

Fig. 272.
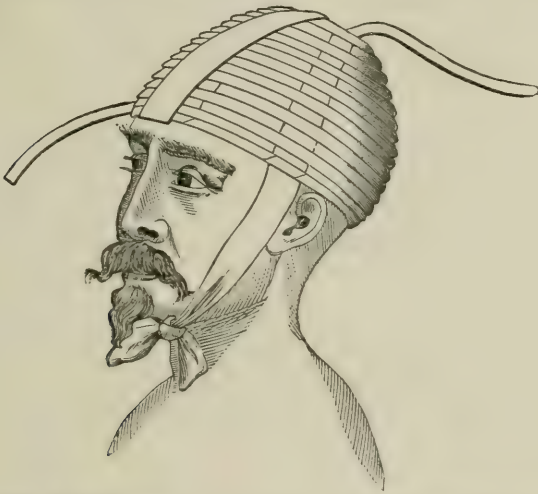
Mediate irrigation ; coil applied to head. (Petitgand.)

suppuration occurring, the pericranium should be incised, and if the exposed bone is discolored, porous, and exuding pus, it should be opened with a small saw or trephine; often the external table only, in the latter case, requires to be removed. In a word, cranial suppurative osteo-periostitis should be treated in the same way as the corresponding affection in a long bone. If the early occurrence of compression makes it probable that there has been extensive hemorrhage from a ruptured sinus or meningeal vessel, the trephine should be used, so that, if possible, the clot may be removed and the bleeding stopped. When later-occurring symptoms indicate that pus has accumulated beneath the skull, although "it is impossible to distinguish intracranial suppuration from arachnitis" (Ashhurst), and although the result of complete trephining in gunshot contusion has been very unsatisfactory—all of the twelve cases thus treated during our war having proved fatal—yet, as the condition if left to itself is almost certain to cause death; and as the simple removal of a button of bone with a conical trephine can only do harm by the resulting admission of air, while such harm can be greatly or altogether prevented by antiseptic after-treatment; and as evacuation of pus may relieve the symp-

[1] Of three hundred and twenty-eight patients with gunshot contusion of the cranial bones, fifty-five, or seventeen per cent., died; ninety-eight, or thirty per cent., were disabled from causes referable to injuries of the head; and one hundred and seventy-five, or fifty-three per cent., recovered.

toms and save the patient, there is certainly good reason why in these cases operative interference should be attempted.

Fig. 273.   Fig. 274.

Perforation of skull by conoidal musket ball. (A. M.   Shell fracture of skull. (A. M. M., Sect. 1,
M., Sect. 1, Spec. 5473.)   Spec. 2871.)

FRACTURES OF CRANIUM.—These, as consequent upon gunshot injury, may be *partial*, only one of the two tables of the injured bone giving away; or, and this is ordinarily the case, *complete*. More or less comminution is usually produced; at times limited to the immediate vicinity of the point struck, but not seldom affecting the bone over a considerable area, or even involving every part of the cranium, with or without associated separation of sutures.[1]

The extensive shatterings are almost always due to shell-injuries, or to perforating wounds made by rifle-balls of large size. When the force of impact is not great, only one of the tables may be broken; usually the *inner*, not because of its special brittleness, but in accordance with Teevan's

Fig. 275.   Fig. 276.
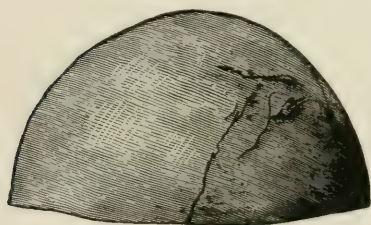
Section of frontal bone, showing fissure over left   Internal view of frontal bone, showing splintering of
supra-orbital region. (A. M. M., Spec. 24.)   vitreous table. (Same specimen as Fig. 275.)

law that the breaking takes place in the line of extension. Fracture of the *outer* table alone very rarely occurs (though it does at times happen) except when the injury is inflicted over the frontal sinus, the mastoid process, or the occipital protuberance.[2] In fractures of the lower frontal region, in children,

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[1] In Circular No. 3, S. G. O., 1871, a case is reported by Assistant Surgeon Yeomans, U. S. A., in which, in consequence of a musket-ball perforation (the ball fired at a distance of 315 yards entering through the posterior part of the parietal, and emerging through the frontal bone), all of the eight cranial bones were broken, as shown at the autopsy. (Fig. 273.)

[2] Otis declared that he was disinclined to admit that the outer table of the skull was ever fractured in the adult, without injury to the inner table, either by projectiles of war or other external violence, except in the rare instances of blows or the impact of missiles upon the superciliary ridges, the mastoid or zygomatic processes, and possibly the occipital protuberance; or in cases of grooving by a sharp shell fragment.

both tables must almost certainly be broken, since the sinus is undeveloped until at or about the period of puberty.

Though, occasionally, fracture of both tables with greater or less splintering of the internal may occur, without depression of the outer, ordinarily the latter condition is well marked, the portion driven down being, at times, quite limited in area, and the fracture a punctured one, but, as a rule, of considerable extent and accompanied with widely extending fissures. The comminution associated with penetrating or perforating wounds is in no small degree, doubtless, due to the hydrostatic pressure developed in the traversed brain. Busch and Kocher's experiments have shown that " in firing at short distance into a skull filled with soft brain-substance, the cranial walls are broken up in all directions and widely scattered." Fractures by *contre-coup* (if such they may be named) may thus be produced by the force of a grazing or penetrating shot, transmitted through the semi-solid cerebral mass to some part of the base of the skull, as in the form of fracture met with in President Lincoln's case,[1] two examples of which have been noticed by Longmore, while six others, from the Russo-Turkish war, have not long since been recorded by Bergmann, of Würzburg—one or both orbital plates being broken, with or without associated lesion of the ethmoid bone. As indicative of the existence of such a basal injury in connection with wound of some part of the vault, may be mentioned " retrobulbar extravasation and exophthalmos, associated probably with a lesion of some of the motor nerves of the eyeball, or even of the optic nerve" (Bergmann); and, if the cribriform plate of the ethmoid has been fractured, anosmia.

The *diagnosis* of gunshot fractures of the skull, if other than linear, and if occupying the vault or sides, is usually easy—the ordinarily associated tegumentary wound permitting a ready determination by finger or probe of the existence of a break. At times, however, even when the shot has penetrated, the elasticity of the skull, aided very probably by the tension of the dura mater, and perhaps by the pulsatile force of the brain itself, may so perfectly restore the fragments to position as to make it exceedingly difficult, it may be impossible, to recognize the osseous lesion, or, still more, to detect an existing penetration with lodgment of a foreign body. In the latter case, the establishment of the diagnosis may be greatly facilitated by the possible presence of a shred of clothing or a hair, carried in by the shot and caught between the edges of the break, as in the case reported by Assistant Surgeon Howard, U. S. A.,[2] though a hair may be driven in by a missile which does not penetrate.[3]

When it is the base of the skull that has been broken, the ball having entered through the face or neck, and when the patient lives long enough to come under treatment—the nature of the injury, if recognized at all, will be so by determination of the length and direction of the track of the bullet, and by observation of the ordinary symptoms of basal fracture produced by violence other than gunshot. Escape of cerebro-spinal fluid, if it occurs, may,

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[1] President Lincoln was killed by a bullet which "entered through the occipital bone about an inch to the left of the median line, and just above the left lateral sinus . . . passed through the left posterior lobe of the cerebrum . . . and lodged in the white matter . . . just above the anterior portion of the left corpus striatum. Both the orbital plates of the frontal bones were broken."

[2] American Journal of the Medical Sciences, Oct. 1871.

[3] As in the case reported from the Crimean war, in which, an undepressed fracture of the upper part of the frontal bone having been caused by a shell-fragment, the spontaneously separated portion of the external table " contained a fissure in its centre, into which some hair had been driven and firmly impacted." (Matthew.)

as stated by Roser, be regarded as indicative of a superficial brain lesion, the swelling following deeper injuries preventing such discharge.

That the missile has lodged, may at times be ascertained by exploration of the wound, or even, in rare cases, by the detection of an elevation of bone on the opposite side of the head, the ball having partially perforated from within outward at such a point; but usually it is, during life, a matter of conjecture simply, only a single wound existing, and there being no evidence of the missile having rebounded or having been deflected after producing the fracture.

Prognosis.—The prognosis of these injuries, though much affected by the nature of the wound, is always grave; not because of the fracture itself, for a broken skull-bone heals as readily as any other, but because of associated lesions and resulting complications. Aside from hemorrhage from a lacerated sinus or meningeal vessel, and actual cerebral damage, the danger is chiefly due to meningo-encephalitis, because of the nearness of the brain, and the facility with which it participates in the lesions of its coverings. This meningo-encephalitis may be developed at an early period, or, as is more usual, after a number of days—particularly in the latter part of the second week—and is ordinarily, though not necessarily, associated with an open wound. As a result, acute suppuration may take place, a cerebral abscess having been observed by Beck as early as the fifth day, though commonly the pus-collection is either not formed, or does not produce any symptoms, until after three, four, or five weeks. When lodgment of a foreign substance has occurred, and the foreign body remains, it may prove the developing cause of suppurative brain inflammation even years after apparent recovery has taken place. In the Crimean war, 74 per cent. of the cases of cranial injury proved fatal (711 out of 961), and during our late war the mortality-rate was 59.2 per cent. (2514 out of 4243 cases the results of which were ascertained).

Fractures of the internal table alone proved fatal in nineteen out of twenty cases (95 per cent.), penetrating fractures in 85.5 per cent. (402 out of 470 cases), and perforating fractures in 80 per cent. (56 out of 70 cases). In civil life, when the injury has been inflicted by a shot-gun charge at short range, with resulting extensive local destruction, the probabilities of a fatal issue are of course very great; but even in such a case, and much more so in a non-penetrating pistol-ball wound, recovery is decidedly more likely to take place than in military practice. For this there are various reasons, such as the earlier and more constant attention that can be given in civil practice; the generally better hygienic surroundings; the less velocity of the vulnerating body, and consequent less damage to the brain; and, not least, the, as a rule, less advanced age of the patient. Young adults bear these injuries better than those in middle or advanced life, and children, who are often the subjects of accidents of this kind, decidedly better yet; and this has been especially noticed with reference to cases of splintering and depression of the internal table.

Injuries of the base are much more dangerous than those of the vault, but it would appear from Lidell's investigations that they "prove mortal much less frequently than heretofore has generally been supposed"—35 out of 137 patients having more or less perfectly recovered, and two or three of these "so completely as to re-enlist." It is generally held, with Guthrie, that a wound of the anterior part of the head is more likely to cause death than one of the posterior. But that such is the fact is by no means certain. In the 316 cases of penetration and lodgment tabulated and analyzed by H. R. Wharton, of which 279 were instances of gunshot injury, the relative mortality of

wounds through the frontal, parietal, and occipital bones, was, respectively, 44 per cent. (58 out of 132), 46.5 per cent. (27 out of 58), and 70 per cent. (16 out of 23); while the death-rate of those through the temporal bone was but 38.7 per cent. (12 out of 31), probably because of the fact that the larger proportion of such injuries never come under treatment. Wounds of the cerebellum almost always prove quickly fatal, though in a case reported by S. W. Gross the patient lived nearly five days:—

"At the expiration of forty-eight hours after the reception of the injury . . . his manner was perfectly rational . . . he complained of no pain in the head, nor suffered from special symptoms . . . his thumbs were adducted and strongly flexed in the palms, and he told us that he suffered from persistent priapism, which we found to be the case. There were no other general symptoms: the man had a good appetite, was continually walking about. . . . On the morning of the 11th (April) we found him in his tent dead, and in the supine position. The calvaria having been removed, the somewhat misshapen buckshot was seen to be in contact with the corpus dentatum of the right lateral hemisphere of the cerebellum. A small splinter of bone was lying in the track of the wound, and the morbid appearances were confined to slight ecchymosis of the cerebellum, and a small quantity of bloody serum at the base of the organ."

In the majority of cases which do not prove fatal, more or less cerebral disturbance is likely to be experienced during the after-life of the individual; headache, irritability, inability to endure exposure to the sun, etc. Epilepsy is a not infrequent result, as is impairment of the special senses, particularly of sight and hearing. Legouest says that he has even seen two cases of immediate and irrecoverable loss of sight after injury of the supra-orbital nerve; though it is probable that such a condition was really due to either frontal fissure extending into the optic foramen, with or without intra-vaginal extravasation, or to hemorrhagic detachment of the retina.[1] Impairment of vision at a later period may be caused by plastic choroiditis. Generally, the blindness after non-penetrating injuries is unilateral; when occurring on both sides, the prognosis seems to be more favorable. Wounds of the mastoid process are very often followed by deafness, and occasionally by facial paralysis. More or less persistent, early aphasia has been not infrequently observed in injuries involving the "language centre."[2] The frequently occurring primary paralysis of the extremities may become permanent in greater or less degree.

On the other hand, no damage other than that which is local and temporary may be produced, and ball and even bone may remain for years in the brain without doing any harm. Such cases, however, are but the fortunate exceptions proving the rule; and many times it has happened that, after a long period of apparently perfect health, death has resulted from the presence of the foreign body.

Treatment of Gunshot Fractures.—Respecting the proper mode of treatment of these cases, there has been and is much diversity of opinion, and, whatever rules may be laid down, individual judgment must, in any given case, largely

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[1] Berlin, upon examining thirty-four such non-penetrating cases, found fractures of the walls of the orbital canal in every one. Cohn observed one case, during the Franco-German war, in which a fragment of shell wounded the right upper eyelid and brow, and caused partial blindness of the right eye. Six months later, on account of the development of sympathetic ophthalmia, enucleation of the right eye was practised, and examination showed that there were remains of a former hemorrhage in front of and behind a projecting fold of the retina, in the region of the macula.

[2] As long ago as during Napoleon's Russian campaign, Larrey noticed two cases of aphasia, due not to gunshot but to rapier and lance wounds, cases in which, however, the lesions did not, at least directly, affect Broca's convolution or the parts immediately about it.

determine what shall be done. Gunshot fractures of the skull differ from other fractures only in the greater probability of the meninges or brain, or both, being damaged.

If there is a *linear* fracture existing without depression or symptoms of compression, the case should certainly be treated expectantly; and yet in these very cases there is a strong possibility that there has been splintering of the internal table, and that there will be developed a meningo-encephalitis, though this latter condition is not a necessary sequence. When there is *comminution* and *depression*, without compression—and, for still stronger reasons, when pressure symptoms are present—it is certainly the part of wisdom to remove the fragments; and this can generally be done by the aid of the elevator, without having recourse to the trephine. But aside from cutting out a little unbroken bone, what added risk is there in judiciously using a conical trephine to open a way by which to get at and remove existing fragments? Notwithstanding that the use of this instrument has been absolutely proscribed by some most experienced surgeons, such as Stromeyer and Neudörfer, it certainly seems as if it were proper in injuries like these. The case is altogether different from that of operating upon an unopened skull for a suspected, but not definitely diagnosticated and located, intra-cranial lesion.

Whether the trephine shall or shall not be used, cannot properly be determined by an examination of statistical tables, embracing as they must do cases of very diverse nature, operated upon under widely different circumstances. The death-rate among the English, in the Crimea, was 75 per cent. (21 out of 28), while during our war, in which the operation was resorted to seven times as often, it was but 56 per cent. (110 out of 196), 3 per cent. less than the general mortality of gunshot fractures of the skull. If penetration has occurred, shall the ball and bone-splinters be sought for? If the cranial opening is large enough to readily admit the finger, careful exploration of the track should be made; if not, and if a probe, or, which is better, an elastic searcher (for instance, a bougie) is used, the utmost care and almost no force must be exercised, lest the instrument should be pushed through the brain substance, instead of passing by its own weight along the sinus. So easy is it to do harm, that it may safely be declared that at least an inexperienced hand should never probe a penetrating head-wound. If the missile or other foreign body is felt, it should be extracted, if this can be done without special damage to the brain, the opening in the skull being enlarged if necessary. The successful removal of a bullet from within the cranial cavity, however, is a piece of surgical good fortune; and very often the ball does less damage than the search which is made for it.

Wharton's investigations would seem to prove that the search for the foreign body is less dangerous than has generally been supposed. Of his 316 cases, of which one-half (160) recovered, in 106 removal was effected with a mortality percentage of 32, while in the 210 in which there was no attempt at extraction, the corresponding percentage of death was 58. Of 111 cases of recovery in which no mental disturbances remained, in 56 the foreign body had been removed, and in 45 left; that is, in 52.8 per cent. of the whole number of the former category, and in only 21.43 per cent. of the whole number of the latter. But it should be remembered that it was probably only in the milder cases, and when the foreign body was superficially lodged, that its extraction was attempted.

TREATMENT OF CEREBRAL COMPLICATIONS.—For the relief of the meningo-encephalitis, which may be developed early, or more likely during the second week, only the ordinary anti-phlogistic treatment can be adopted, rest and cold being by far the most important elements thereof. When there is a sudden increase in the severity of the symptoms, especially the headache, or

intense cephalalgia appearing at a later period, with progressive stupor, and often rigors or convulsions, making it very probable that an intra-cranial abscess has been formed, the fractured bone should be removed, particularly if there is such paralysis present as suffices to fairly locate the pressure in the immediate vicinity of the break, and an incision should be made through the coverings and into the brain, so that, if possible, exit may be given to the pus. Though the chances of relieving the patient under such circumstances are very slight, yet, as in the case reported by Assistant Surgeon Weeds, U. S. A.,[1] recovery may follow the operation; and, if left to himself, a man thus affected is sure to die. The *hernia*, or, much more commonly, the *fungus cerebri*, which not infrequently occurs,[2] especially in young persons, and which, as when due to cranial and meningeal injuries not produced by gunshot violence, is so generally followed by death, is best treated by simple and moderate compression; operative interference, whether by removal, cauterization, or injection, seldom avails to prevent a fatal termination.

Of the value of the *antiseptic method* in gunshot head-wounds of all kinds, it is impossible as yet to express any positive opinion. If in the future it prove to be true that it is not the injury of the hard or soft tissues, nor the lodgment of ball or bone, that causes death—except when there occurs fatal hemorrhage, or when parts of the brain essential to life are destroyed—but pathological processes which are due to morbific agents in the air that gets access to the wound, then in the adoption of some form or other of germ-destroying or germ-excluding dressing, will lie the safety of the wounded.

Gunshot Injuries of the Face.

Wounds of the *face*, though frequently met with, and often causing great deformity, are comparatively seldom the cause of death,[3] and then usually from hemorrhage, or from the results of maxillary fracture. Flesh wounds, if produced by single bird shot or small bullets, are rarely attended by any material destruction of tissue, are quickly recovered from, and are ordinarily followed by little or no disfigurement. When the vulnerating body is of large size (as, for instance, a charge of shot at close range, a shell fragment, or a musket ball), and when the nose, lip, eyelid, or ear, is extensively damaged, great deformity is likely to be produced, and unfortunately plastic surgery is not very often of much avail in relieving the effects either of the original loss of substance, or of the cicatricial contraction. Injury of Steno's duct may be followed by salivary fistula. In wounds of the orbital cavity, even those produced by bullets of large size, the eyeball may escape injury; but generally it is more or less damaged, perhaps destroyed outright, perhaps so contused or lacerated that destructive inflammation is soon lighted up, or that the lesion is followed by so-called "sympathetic ophthalmia" of the other eye, which is very generally not sympathetic at all, but probably due, as claimed by Lebert, to the direct transference of septic germs along the lymph spaces of the optic nerves. Immediate and total blindness of one or both eyes is at times caused by the passage of a shot from side to side through the optic nerve or nerves, no other serious damage in some of the cases being done. Penetration of the cranial cavity through the orbit

[1] Nashville Journal of Medicine and Surgery, April, 1872.
[2] Otis reports 61 cases, of which 50 proved fatal.
[3] The mortality-rate during our war was 5.88 per cent. (462 deaths out of 7868 cases), flesh wounds proving fatal in 1.54 per cent., orbital wounds in 5.7 per cent., and fractures in 11.4 per cent. of the cases.

almost always causes death; of eighteen such wounds noticed in Wharton's table, seventeen died (94.44 per cent.). In civil life, the eyeball is not infrequently struck by a piece of exploded percussion cap that may produce simply an incised wound of the cornea or sclera, or may penetrate and lodge; and similar injury may be caused by a bird shot. In numerous cases, rifle bullets and other projectiles of considerable size have entered through small openings in the lids, or even under them, and either have lodged deep in the orbital cavity or have penetrated the base of the skull.

In a large number of these cases of gunshot wound of the face (more than one-third during our late war) *fracture* occurs, most commonly of the inferior maxilla; death results in about one-ninth of the cases, and a very considerable proportion of the remainder are followed by great deformity, suffering, paralysis, or interference with mastication. Occasionally the greater part or even the whole of the face is carried away by a large shot or a shell fragment, and very extensive destruction is often produced by suicidal shooting through the mouth, or by the discharge of a pistol held close against the chin. By the passage of a bullet through the superior maxilla, the upper dental arch may be entirely detached from the body of the bone, or, as in a case reported by Longmore as having occurred in the Crimea, the palatine process of one side may be separated and turned at right angles to its fellow.

Associated wound of the *tongue* often occurs, with or without considerable loss of substance, and at times with lodgment of a foreign body (piece of bone, tooth, ball). The primary hemorrhage in these cases may be quite profuse, and a very troublesome secondary bleeding from the lingual artery, or its dorsal or ranine branch, is of common occurrence. Local inflammation, frequently of high grade, is soon developed, and the resulting swelling may become so great as to threaten suffocation. When the anterior part of the organ has been carried away, or when its under surface has been much torn, there is danger of the tongue being so tied down by later cicatricial contraction as to be seriously interfered with in its movements. Balls, even of large size, may lodge in the *antrum* or in the *nasal fossa*, or may fix themselves in the walls of these cavities, frequently remaining there for years, at times causing no trouble, but generally producing more or less slowly progressing necrosis—a process which occasionally secures spontaneous elimination of the foreign body into the nose, mouth, or throat.

COMPLICATIONS OF FACE-WOUNDS.—Primary, and of greatly more importance, secondary *hemorrhage* from the lingual, facial, or internal maxillary artery, is a frequent complication of wounds of this region, and is the most common cause of a disastrous result: indeed, to this and to the effects of suppuration from bone-disease are due most of the deaths among these cases. Fractures of the lower jaw, with extensive loss of substance, are at times followed by *fibrous union*, with consequent impairment of function. True *anchylosis* of the temporo-maxillary articulation, and more frequently false anchylosis from the presence of cicatricial bands, may occur, and much inconvenience often follows from adhesion of the tip or side of the tongue to the lower jaw. *Paralysis*, more or less well marked, results in many cases from injury of the facial nerve, and at times *muscular twitchings*, which may persist throughout the after-life of the individual. It is in this region especially that in civil practice troublesome *powder stains* are met with, the unburnt grains lodging beneath the epidermis or the conjunctiva, or in the cornea, and producing, if not early removed, very disagreeable markings, while even if they are taken away, permanent tattooing often remains.

TREATMENT.—The *treatment* of these injuries is in general very simple, flesh wounds, unattended with much destruction, requiring only the removal of any foreign bodies which are present, and the adoption of the ordinary local measures employed in the management of gunshot wounds. The lacerated and contused soft parts are not to be removed, but readjusted as accurately as possible, and held in place, either by strips of gauze fixed by collodion, or better by sutures or pins; the abundant blood supply of the face secures the preservation of vitality, and oftentimes very speedy repair. In cases of *fracture*, no fragments that are in any degree attached are to be taken away, but are to be restored to position, and are to be held by appropriate dressings, or by frequently applied pressure of the finger, or, if about the mouth, by that of the tongue, the moulding influence of this organ often producing effects which are quite surprising. When the bones of the nose are shattered, every care should be taken to prevent or at least to lessen the sinking in of the bridge, which causes so unpleasant and suspicious a deformity. Fractures of the inferior maxilla are to be treated like similar injuries consequent upon blows, falls, etc. When there has been great destruction of the anterior part of the bone, with its overlying soft parts, every effort should be made to bring forward the edges of the tegumentary wound, and to prevent adhesion of the tongue. Unfortunately, in a large proportion of these cases, great deformity will result, but it may often be very much lessened by subsequent plastic operations. As far as possible, the secretions of the wound are to be drained away from the throat, since their being swallowed not only adds greatly to the discomfort arising from the injury, but, if they are abundant, destroys the appetite, impairs digestion, and may contribute much to the production of a fatal result.

Secondary *hemorrhage* is to be arrested by ligation of the bleeding vessel, when it can be found, or by the use of ice, hot water, the hot iron, or compression. When these measures prove insufficient, the lingual, facial, or external carotid artery, according to circumstances, should be tied. Ligation of the common carotid, though frequently resorted to, should not be adopted if it is possible to avoid it, being both dangerous and unreliable. Of 111 cases in military practice, 81 (73 per cent.), and of 16 in civil practice, 4 (25 per cent.), or, taken altogether, 85 out of 127 (67 per cent.) cases have terminated fatally, while death has also followed in three out of seven cases of ligation of the external carotid alone, or 42.85 per cent. (Wyeth). Of the 54 cases of ligation of the common trunk which occurred during our late war, in at least 14 (26 per cent.) there was subsequent hemorrhage; and of the remaining 40 cases, 14 ended fatally in the first week, and 11 of these within the first four days; so that it is fair to infer that had the patients lived a little longer, there would have been a decided increase in the number of secondary bleedings.

Wounds of the *eye* and its appendages are to be treated like those produced by other causes; if lodgment of the foreign body has taken place, and vision has been destroyed, the eyeball should be removed at once, to prevent the development of sympathetic ophthalmia. If a considerable part of the *ear* has been carried away, little or nothing can be done to correct the resulting deformity; but this is a matter of comparatively small importance, since the hearing is not affected, and the disfigurement can generally be readily concealed. If the bullet has lodged in the external auditory canal, it should be removed, even if it be found necessary to displace forwards the auricle and cartilaginous meatus in order to do so.[1] *Powder grains* are to be carefully

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[1] Green, of Boston, has recently reported a case in which by making "a semicircular incision above and behind the auricle, through the periosteum," carrying forward "the periosteum with the auricle till the edge of the osseous meatus was reached," and cutting through "the insertion of the cartilaginous into the osseous passage in its upper and posterior part," he was able to discover and remove three pieces of two small pistol balls which had been fired directly into the ear.

picked out, or, if they are so placed as to render it practicable, a blister may be applied, upon the drawing of which the grains will be found either detached or so loosened as to be readily removed.

Gunshot Injuries of the Neck.

Wounds of this region are, as a rule, of importance only when involving the air-passages, the pharynx or œsophagus, the great vessels, or the larger nerves. Mere contusions from spent balls or shell fragments may cause temporary paralysis of the muscles of the neck, or of the upper extremity, or even muscular rupture with resulting distortion, and may be followed by more or less sloughing. Superficial wounds, that is, those not passing through the deep fascia, usually heal in due time—often very quickly when produced by small pistol balls or bird shot—though occasionally the cure is much delayed by the supervention of erysipelas, or of suppurative inflammation of the sub-cutaneous connective tissue. Of the deeper wounds, those of the lower part of the neck are more dangerous than those of the upper, death in many cases of the former category being consequent upon the extension of inflammation along the fascial planes to the parts within the thoracic cavity. When the injury is confined to the posterior part, but comparatively little damage is usually done, unless the vertebræ are wounded, although temporary paralysis, even to the extent of involving all four extremities, may result from spinal concussion, and more lasting paralysis and muscle-atrophy from lesion of the nerves soon after their emergence from the vertebral canal. Injuries of the *muscles* are ordinarily recovered from without difficulty, and with no serious after-results other than, at times, deformity consequent upon cicatricial adhesions, when the superficial tissues have been extensively destroyed, and upon contractures from loss of substance in the muscles themselves. Torti-collis, which chiefly follows wounds of the sterno-mastoid, may be permanent, or, as is more usually the case, may ultimately disappear, either wholly or in great measure.

The exposed position of the *larynx* and *trachea* renders them quite liable to injury, though actual penetration is in a limited number of cases prevented by their deflection of musket bullets and much more frequently of small balls and shot. Small shot may even pierce the cartilaginous wall and lodge under or in the mucous membrane, laryngitis or tracheitis being in consequence developed.

I once examined, after death, a case of this sort, in which a charge of bird shot at short range " peppered" the upper part of the left chest and the front of the neck, making an extensive laceration just above the right sterno-clavicular articulation. The fatal result was due to laryngitis consequent upon the lodgment of a single shot under the mucous membrane covering the left wing of the thyroid cartilage.

Very rarely does the missile enter the air-tube without passing through, though such cases have been observed, the vulnerating body producing results similar to those which follow the introduction of any solid substance through the glottis. Suffocation, actual or impending, may be produced by the pressure of inflammatory products external to the trachea. Cicatricial contraction after extensive destruction of the anterior part of the larynx, or inflammatory stenosis, may compel the permanent wearing of a tracheal tube. Aphonia, in greater or less degree, very frequently follows injuries of this sort; necrosis of the cartilages is quite likely to occur; and aërial fistulæ at times remain.

A missile passing high up may wound the *pharynx*, or, at a lower point, the *œsophagus;* only very rarely is there associated lesion of both the air-

and food-tubes. The existence of an opening into the pharynx or œsophagus may be proved by the ready escape, through the external wound, of liquids or semi-solids taken into the mouth; in many cases the presence of such an injury is but conjectural, from the line of direction of the shot; and occasionally it is revealed only by an autopsy. Persistent fistulæ are not unlikely to follow such lesions. Outflow of alimentary substances through a laryngeal or tracheal wound does not necessarily indicate opening of the pharynx or œsophagus, as it is at times due to impaired functional integrity of the epiglottis, permitting the entrance of food or drink from above into the air-passage.

Much the most dangerous of the neck wounds are those involving the *great vessels*, many of these causing speedy death from primary hemorrhage. Oftentimes even the large arteries and veins escape injury in a remarkable manner, and, when wounded, bleeding is occasionally prevented temporarily by the bullet lodging against the opening and plugging it; or, after the first gush, the discharge of blood may be, though very seldom, permanently arrested by the presence of a clot. *Traumatic aneurism* is not infrequently developed, and *arterio-venous aneurisms* have also been observed in these cases. Extensive *extravasations* of blood may take place, at times causing serious or even fatal pressure upon the air-tube; and considerable quantities of blood have been found poured out within the carotid sheaths. Medium-sized bullets may lodge in the carotid artery or in the internal jugular vein, or may become encysted upon the vessel's wall, or, after entering, may drop down and be arrested at a lower level. Wounds of the *nerve trunks*, unaccompanied by grave injuries of the bloodvessels, of the spine, of the head, or of the chest, cause the ordinary disturbances of motion and sensation in the parts supplied, and by reflex action, in certain rare cases, in regions quite remote. Lesion of the hypoglossal nerve has been followed by motor paralysis and unilateral atrophy of the tongue;[1] that of the sympathetic, by contracted pupils, ptosis, and flushing of one side of the face;[2] to injury of the pneumogastric, was attributed by Larrey the intense thirst which is at times experienced by the subjects of œsophageal wounds; injury of the brachial plexus, whether produced by ball or bone fragment, very often causes not only the usual muscular affections in the upper extremity, but trophic changes in the skin, and that burning pain (*causalgia*) which is "the most terrible of all the tortures which a nerve wound may inflict." (Mitchell.) Mere pressure of a lodged ball may give rise to severe nervous symptoms, which disappear with the removal of the foreign body.

Of this an instance is reported by Sawtelle, in which pain, clonic contractions, and sensitiveness to heat and cold, were through nearly seven years produced by a conoidal ball that entered "about half an inch above the left clavicle and about one inch from its sternal extremity, passed transversely between the trachea and the œsophagus," and lodged on the right side "between the subclavian and a branch of the brachial plexus, the ball resting on the artery just where it emerges from beneath the clavicle, with the nerve drawn tightly across the missile in front." Removal of the bullet was followed by rapid healing and progressive relief of suffering, so that in two and a half years the recovery was declared to be entire, "with the exception of a very slight sensitiveness of the fingers to cold and heat."

Occasionally several of the important nerves are simultaneously injured, as in a case reported by Stromeyer, in which the phrenic, the pneumogastric, the middle ganglion of the sympathetic, and the descendens noni, were wounded together with the larynx and pharynx. It sometimes happens that a deeply penetrating shot, although it may not directly damage important structures,

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[1] Mitchell, Injuries of Nerves, pp. 218, 335.   Philadelphia, 1872.   [2] Ibid. p. 318.

may cause a burrowing abscess which by subsequent ulceration of a large vessel, or by descent into the chest, will bring about a fatal result.

In a case of this sort reported by Surgeon O. A. Judson, U. S. V., the abscess cavity "reached upward five or six inches along the spine, and downward in the mediastinum to the bifurcation of the trachea, where the ball was found, point downward and resting against the right bronchial tube."

PROGNOSIS.—Leaving out of consideration such as necessarily and quickly prove fatal from hemorrhage, or from associated injury of the brain or spinal cord, neck wounds cause death in a much smaller proportion of cases than might naturally be expected from the number and importance of the structures contained in this region.[1] At least one-half of the wounds of the air- and food-tubes that come under treatment terminate fatally, and in a large proportion of those made by musket balls, there are associated lesions of more important parts that speedily cause death. As a rule, when one of the great bloodvessels is opened by a shot, life is quickly destroyed by the primary hemorrhage; but the bleeding may be arrested by compression (as in the well known case of the Duke of Padua, reported by Larrey), by the presence of the ball, or by the formation of a clot, and an opportunity may thus be afforded for the application of a ligature or of methodical pressure. According to S. W. Gross, wounds of the internal jugular vein have always resulted fatally, but in two of the cases which he cites (Schwartz's and Stromeyer's), the rent in the vein was completely healed at the time of death from pyæmia. Contusions of the main vessels are very likely to be followed by secondary hemorrhage, the detachment of the slough generally taking place at about the end of the second week, though sometimes much later; in a case of injury of the common carotid, observed by Cruz, of Lisbon, the bleeding "did not show itself until the thirty-seventh day." The prognosis in cases of nerve-wound unaccompanied by other grave lesions, is favorable as respects life, but not so as regards the after-comfort of the patient and the usefulness of the parts supplied by the damaged nerves.

TREATMENT.—In the treatment of all varieties of neck-wounds in which the missile has lodged, unless this is quite small, it should be removed, provided that its location can be determined, and that it can be reached (if necessary) by a careful dissection which will not in itself seriously imperil life. Though balls may remain for years without causing inconvenience, yet in the great majority of cases their presence does harm, and not infrequently develops severe and often fatal inflammation. Even after such inflammation has been lighted up, it may quickly subside upon the removal of a foreign body, the lodgment of which, though it is perhaps of large size, may not have been at first suspected.

In a case reported by Duplay, a mitrailleuse ball, more than an inch and a half in diameter and of over six ounces weight, was for nearly four months lodged undiscovered between the lower jaw and the hyoid bone. Upon its removal, rapid healing took place.

Injuries of the *larynx*, *trachea*, *pharynx*, or *œsophagus*, are to be treated in the ordinary way. Threatened suffocation, if due to pressure of extravasated blood, or superficially located effusions and exudations, is to be relieved by free incision and by removal of the clot, if such be present, or by tracheotomy; if to œdema of the glottis, by scarification, or by the opening of

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[1] In only 15 per cent. of the nearly five thousand (4895) cases tabulated by Otis, and even this is declared to be an excessive ratio because of the inclusion of many cases of grave injury that never came under treatment.

the air tube; and by the latter operation, if consequent upon inflammatory stenosis located sufficiently high to permit of the incision being made below the point of obstruction, or by the introduction of a tube through the original wound. Tracheotomy, in all these cases, is quite likely to be followed by a fatal result, not because of the operation itself, but because of the conditions by which it is rendered necessary. It was resorted to six times during our late war—twice successfully. In cases of lesion of one of the large *bloodvessels*, the resulting hemorrhage, whether primary or secondary, should be arrested by the application of ligatures above and below the wound, if such can be safely found; otherwise, by compression. When it is an important branch of the external carotid that has been damaged, if it cannot be duly tied on either side of the wound, the ligature should be placed upon the external carotid itself, and not upon the common carotid. The ligature of the latter trunk is, as we have already seen, though easier of execution, much more dangerous and more likely to be followed by after-bleeding, and the operation should not be resorted to except for wound of this vessel itself. The internal jugular vein, when wounded, should be tied rather than compressed, though by methodical pressure hemorrhage from this vein has often been arrested. As has been before noticed, Langenbeck has advised in these cases that either both the common carotid and internal jugular, or, preferably, the common carotid alone, should be ligatured. Two objections have been strongly urged against tying the vein: (1) that phlebitis was likely to be developed, and (2) that cerebral damage would ensue from the resulting interference with the return circulation. The first objection is now known to have but little weight; and as respects the second, though cases have been reported of early occurring apoplexy after ligature of this vessel, yet by many experiments, as recently by those of Nicaise, it has been clearly shown that an ample collateral venous circulation may be expected to be rapidly established after ligation of the internal jugular vein, as also after that of the subclavian.

Gunshot Injuries of the Chest.

About one in twelve (at least one in twenty) of all gunshot wounds are of this region, and here, as in the head, the injury may affect the soft parts only, or the bony wall, or the contents of the cavity; and the gravity, aside from the comparatively few not immediately fatal cases in which the large vessels are damaged, is directly proportionate to the extent of visceral lesion.

Non-penetrating Wounds.—Superficial wounds, even if of large size, *unattended by fracture*, rarely cause death—in perhaps only one out of every two hundred cases—though, owing to the constant movement of the chest, healing usually takes place very slowly. Very long seton tracks are not seldom met with, the ball running around over the ribs; and on this account, an erroneous diagnosis of perforation is oftentimes made. Occasionally, and then almost always as the result of contusion by a shell-fragment, there is an associated serious lesion of the lung, laceration or rupture—a lesion which probably can only occur when the glottis happens to be firmly closed at the moment of injury. Such an accident generally, though not inevitably, proves quickly fatal; 25 cases collected by Otis gave 11 recoveries.

When any part of the bony wall is *fractured*, the wound becomes one of much greater importance, not only on account of the fracture itself, but, in higher degree, because of any accompanying injury of the subclavian or axillary vessels, when the clavicle or scapula is wounded, and of the intrathoracic viscera, the pleura, or the intercostal or internal mammary arteries,

when it is a rib or the sternum that has been struck.   Circumscribed pleurisy is a frequent but not necessary consequence of costal fracture, and extensive necrosis may follow the bone-injury.   When the fracture is produced by an out-going shot, it is (as was originally pointed out by Brinton) decidedly less

Fig. 277.
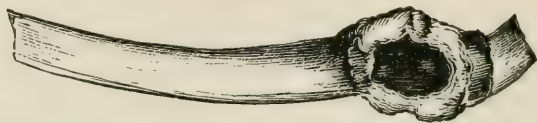
Gunshot fracture of rib by round musket-ball which was embedded.   (A. M. M., Sect. 1, Spec. 887.)

dangerous than under other circumstances, all splinters being then carried away from the cavity, and bone-fragments being more likely to do harm to the lung than the bullet itself.   Small balls at times bury themselves in the ribs, or in the sternum, and a bullet of even large size may wedge itself firmly in an intercostal space, ultimately, if not removed, working its way externally, or by ulceration and absorption getting into the pleural sac.   When a costal cartilage is struck by other than a small missile, fracture takes place, but without a scattering of fragments.

The treatment of non-penetrating chest injuries, whether there is or is not fracture present, is that of like wounds in general, in no way materially modified because of location.   *Foreign bodies* are to be removed, if they can be found; but their discovery is at times very difficult, as when the projectile, even if of large size, is lodged under the scapula, or buried deep in the muscles of the back, or in or near the axillary space.   *Hemorrhage* is to be arrested, preferably by ligation of the wounded vessel above and below the point from which it bleeds, or, if this cannot be done, by compression, or by the use of cold, or of hot water.   The exceedingly dangerous bleedings from the axillary vessels (those from the artery being much graver than those from the vein) which often cause rapidly forming, diffused, traumatic aneurisms and blood-tumors, though undoubtedly they have at times been stopped by compression, yet can be safely treated only by ligation, at the seat of injury rather than above it, or by ligation followed by amputation of the whole upper extremity. Wound of an intercostal artery, though fortunately not very common, may, when it does occur, especially if located far back, give rise to a very considerable hemorrhage, which is to be treated by direct compression rather than by ligation, an operation which is here neither easy nor safe; of eight cases in which it was attempted during our civil war, six proved fatal.   Formal *excision* of fractured bones should not be employed, except at a late period, for extensive necrosis; though the sharp ends of a broken clavicle or rib may often with advantage be cut off.   As in simple fracture, compression of the chest or half chest with a broad bandage, with adhesive straps, or with a plaster-of-Paris roller, will afford much comfort and hasten recovery.

PENETRATING WOUNDS.—It is to penetrating injuries that the special interest of thoracic wounds attaches.   Though they may vary greatly in the amount of damage done, and in the complications developed, they are always grave lesions.   In military surgery, many of the subjects of these injuries are left on the field, and in civil practice speedy death is not infrequent.   For their production, it is not absolutely necessary that the projectile should enter the thoracic cavity, as the pleura, alone or together with the lung, may be wounded by bone-fragments.   At times, chiefly when the vulnerating body is a pistol-ball or a small shot, laceration of the pleura or even penetration

of the lung may occur without associated fracture, the missile entering through an intercostal space. Still more rarely, in an apparently external seton wound, the ball may cut the serous membrane for a considerable distance in its passage between two ribs. In the non-fatal cases of entrance, with or without lodgment, it is usually the outer surface, or the thin edge, of the lung that is wounded, though exceptionally the shot may pass through the thickness of the organ, or may even be buried close to its root. This last form of injury is generally followed by death from hemorrhage; almost certainly so unless the missile be of small size. Occasionally a bullet, after wounding the pleura, runs over the lung for a variable distance, to be either deflected internally, or to emerge through a rib or an intercostal space. Very rarely, if ever, does a rifle-ball pass from side to side through both lungs, and the patient recover.

A *lodged bullet*, if the wounded individual lives, is very apt to become encapsulated, though at times it may be found in an abscess cavity, or may enter a bronchial tube, and be coughed up; or the œsophagus, and pass downwards or be ejected through the mouth; or, if superficially placed, it may so work its way externally as to make it practicable for it to be readily removed; or, adhesions not preventing, it may drop down in the pleural sac, where it may either remain free, rolling about upon the diaphragm, or, which is more probable, may rest in the postero-internal angle. A spiculum of bone is more likely to cause the formation of an abscess, and may in this way, or by ulceration, find entrance into a bronchial tube; though it may, especially if small, remain innocuous in the lung tissue either with or without capsular investment. Penetration may occur without lung wound, the missile damaging the pericardium or heart, or lodging in the mediastinum, or even passing directly through without injuring any important structure.

In a remarkable case reported by E. S. Cooper, in which, however, the lung was injured, an iorn breech-pin was lodged "beneath the heart, upon the vertebral column, just to the right of the descending aorta," from which place it was successfully removed seventy-four days later.

During the Ashantee war, in 1873, there died of dysentery an English naval officer who, in 1860, in New Zealand, had been wounded in the right breast, the resulting symptoms being so slight as to make it very doubtful if penetration had occurred. Upon *post-mortem* examination, there were found a cicatrix above the right nipple; evidences of damage to the fourth rib near its cartilaginous junction; and an encysted round ball, about half an inch in diameter, lying "outside the pericardium, above the right ventricle, in the triangular interspace between the aorta and the pulmonary artery."

Hernia of the lung is very rare, and, when it does occur, is almost always a primary complication, though it may appear at a later period in consequence of the feeble resistance offered by a cicatrix. When the missile passes through the seventh, eighth, or ninth intercostal space, especially the latter, and when the diaphragm is wounded, particularly on the left side, *omental hernia*, or even visceral protrusion, may result. If the diaphragm is strongly arched at the time of injury, it may be wounded in two places, and herniæ may occur through both. When the protrusion is recent, and the presence or absence of crepitation in the tumor can be readily and certainly determined, it is easy to distinguish between a pneumocele and an epiplocele, but at a later period, after inflammation and strangulation have occurred, a differential diagnosis cannot usually be made. As the result of the injury of the lung, circumscribed inflammation may be expected to occur along the track of the ball; but ordinary *pneumonia* is rarely developed—never as the direct consequence of the traumatism alone. The inflammation of the *pleura* may be limited and protective (and in this sense only is it true, as declared by Mouat, that "the inevitable result of a wound of the lung is pleurisy"), or, as is often the case, may

be general and purulent, because of the escape of blood, and its admixture with air from the exterior, or from the opened air vesicles or bronchial tubes. When the entrance wound is large, or the pleural effusion abundant, compression of the lung takes place—to be subsequently, in cases that recover, more or less relieved by absorption or discharge.

Lesions of the *pericardium* or *heart*, if not quickly fatal, give rise to pericarditis and endocarditis of varying extent and duration, and a lodged shot may become encapsulated. *Mediastinal wounds* may cause suppurative or gangrenous cellulitis.

Diagnosis of Penetrating Wounds.—The diagnosis of penetration, aside from cases in which an external opening is associated with profuse hæmoptysis, is often by no means easy, and is to be based upon an aggregation of symptoms rather than upon any one symptom by itself. *Spitting of blood* may be present when the lesion does not directly affect the lung. *Shock*, perhaps in high degree, may show itself when the lung is undamaged, and is often absent even when a fatal penetrating wound has been received. Severe *bleeding* may arise from an intercostal or the internal mammary artery, and *hæmothorax* is not uncommon after a lesion of the former. In *pneumothorax*, the air may come from without, and in the very rare cases of *emphysema* which follow a bullet wound, the effused air may have been sucked in from the surrounding atmosphere, and not forced out of lacerated air-vesicles or tubes. *Traumatopnœa*, while it shows that there is an opening of the pleural cavity, does not prove that the lung has been torn. *Dyspnœa* from pleural accumulations of blood, air, or pus, cannot be regarded as pathognomonic, since each of these exciting causes may exist independently of lung wound. The late-occurring *lumbar ecchymosis* of Valentin is very often absent, and is of no special importance in the cases in which it does occur, having really little or no diagnostic value. From the presence of *two wounds*, perforation cannot be predicated, since the ball may have run around the body, or the patient may have been struck by two shots. Early and persistent, marked *reduction of temperature* furnishes strong presumptive evidence of visceral lesion. Injury of the *heart* or *pericardium* is rendered probable by quickly appearing, great shock and precordial oppression, with succeeding pericarditis or endocarditis.

Prognosis.—The prognosis of these penetrating wounds is very grave. Among the Russian wounded in Sympheropol 98.5 per cent. of those who were thus injured died, as did 91.6 per cent. among the French and 79.26 per cent. among the English in the Crimea. Of 7929 cases observed during our war 5169 (65.19 per cent.) ended fatally, and if the non-fatal cases in which errors of diagnosis were made could be eliminated, the mortality rate would unquestionably be carried decidedly higher. In civil life—the missiles, as a rule, being smaller, the cases coming under treatment earlier, and the patients not being subjected to added dangers from transportation—the prognosis is more favorable, but still bad enough. Even in cases which do not terminate fatally, in both military and civil practice, long-continuing or permanent fistulæ may remain. *Heart wounds*, when made by large balls, almost always prove quickly fatal; when made by small bullets or shot, life may be prolonged for a considerable period of time, and recovery even may take place.

In a case which I have elsewhere reported, and which was under my own observation from the time of injury to that of death, three years and two months later, a small pistol-ball, as was proved by an autopsy, passed through three of the four cavities of the heart, and lodged in the root of the right lung—the boy, aged 15, ultimately dying of the effects of the cardiac disease.

Pericardial injuries are much less dangerous than heart wounds: four out of the seven cases in Fischer's table ended in recovery.

Treatment.—The treatment of penetrating wounds of the chest depends upon the *size* of the vulnerating body; upon whether *lodgment* within the cavity has or has not taken place; and upon the *complications* that may be early or late developed.

When the missile is small—and such it is likely to be in that large proportion of cases treated in civil practice in which the injury is produced by a pistol ball—if the shot has passed through and can be felt lodged under the skin, it should be removed, but should otherwise not be searched for. In wounds by large bullets, or by a fowling-piece charge at short range, the track of the wound should be explored by the finger, and any foreign bodies that are discovered (lead, buttons, clothing, bone fragments), removed. If, as is likely to be the case, the ball has passed beyond the point which can be reached by the finger, shall any probing be done? Not with a metallic instrument. An elastic bougie, or a gum catheter, may very properly be used, if guided by intelligence and judgment; since if the lodged substance can be found and removed, either through the wound or through a counter-opening, the patient's mind will be put much at ease, and the after local mischief will probably be much less. But the chances of finding the ball, except when it is very superficially located, are not great—much less than the possibilities of doing harm; so that here, as in head injuries, it is, as a rule, safer and wiser for all except the most experienced to rest content with the knowledge acquired by digital exploration, that penetration has *probably* taken place, and to let the foreign body remain, trusting that it will either become encysted or be spontaneously expelled through the air passages or the œsophagus, or that it will be brought near to the surface by suppuration so as to be easily removed when the abscess is opened, or extracted through a sinus. If at any time during the progress of the case, the bullet can be discovered free at the bottom of the pleural sac, it should be taken out, either through an existing opening or through one specially made in the posterior part of one of the lower intercostal spaces.

Hemorrhage from an intercostal artery is to be arrested, as already stated, by plugging; and if from the *internal mammary*, by ligation—direct, if possible; if not, higher up, in the second, third, or fourth intercostal space. This operation was twice employed during our war, though unsuccessfully; but pressure and styptics were equally unavailing in saving life in the four cases in which they were tried. The bleeding from this vessel then when it does occur, which is not often, is to be regarded as a very serious matter. When the hemorrhage, though from neither of the above-mentioned arteries, is yet profuse, it should if possible be checked by rest, by the application of cold, and by the administration of ergot—preferably hypodermically; the patient meanwhile should be placed in such a position that the blood will flow off through the wound. Pressure upon, and closure of, the external opening will often be found of great service, but "hermetically sealing," after the method of Howard, has proved to be far from advantageous. Effusion of blood into the pleural sac, whether from an internal or an external source, if of limited amount, is usually absorbed without difficulty, with relief of the primary symptoms, shock, pain, and dyspnœa. When the extravasation is large, death may take place quickly from the hemorrhage and lung compression, or more slowly from empyema, or, the bleeding having been arrested by the pressure of the clot, absorption may follow, the lung may expand, and the patient may recover. In all of these cases, absolute rest must be enjoined, and cold, opium, and ergot should be employed according to circumstances. The external opening may be closed in order that by compression further

bleeding may be prevented, but if the dyspnœa becomes extreme, the wound must be reopened and the blood allowed to escape. If the outflow is not sufficiently abundant, aspiration or paracentesis may be practised; or a free incision may be made in an intercostal space, and, if necessary, the pleural sac may be thoroughly washed out; such an opening of the cavity can do little or no harm, air having already gained access from the first along the track of the bullet.

The old time treatment of chest wounds by *venesection* is not to be adopted, since it will almost certainly but add to already dangerous conditions, that of "irrecoverable exhaustion." *Pneumothorax*, if producing severe dyspnœa, which is not of common occurrence, should be relieved by tapping. *Purulent accumulations*, whether due to decomposition of blood from the entrance of air either from without or from the wounded lung, or to general pleuritis, may at times be removed by aspiration or by tapping, but are, as a rule, best treated by free incision with or without removal of part of a rib or ribs, and by subsequent cleansing of the cavity and maintenance of drainage, which should be as thorough as possible. Very generally, however, though temporary relief is thus afforded, cases of gunshot empyema sooner or later terminate fatally.

That recovery may take place in cases of great severity, is well illustrated by a case reported by Schneider of Königsberg, in which after a pistol-ball wound of the chest smashing the fourth rib, *pyo-pneumo-hæmothorax* occurred, together with sloughing of the upper lobe of the lung. In order that the ribs might close in upon the unfilled cavity, resection was practised—part of the clavicle and pieces of the second, third, fifth, and sixth ribs, of from two to four and a half inches in length, from the costo-chondral junction outwardly, being removed. The resection wounds healed by first intention, the chest wall collapsed, and the man recovered.

The ordinary, limited, *pleural* and *pulmonary inflammation* along the track of the wound requires no special treatment. The lung injury may be so perfectly recovered from that auscultation will fail to indicate that any damage has been done, but usually the physical signs of the existence of condensed cicatricial tissue will ever after be present. Tubercular disease has ultimately been developed in a considerable proportion of the patients who have apparently completely recovered from lung wounds; but in what degree this disease has been really consequent upon the injury, it is impossible to determine.

A quickly appearing *hernia of the lung*, if seen before any inflammation or strangulation has taken place, should, if the protruding portion is unwounded, be, if possible, at once reduced, the opening in the chest wall being enlarged if necessary, and a retentive dressing being afterwards applied; at least once (Angelo's case), such a reduction has been successfully effected. When injured or already inflamed, the protrusion should be left undisturbed. If there has been a wound of the diaphragm, and a portion of the contents of the abdominal cavity protrudes, similar treatment should be adopted. Injuries of the *pericardium* and *heart*, which do not quickly cause death, should be treated at first by rest, cold, and closure of the external wound, the latter being subsequently reopened if symptoms of dangerous compression are manifested; in the beginning, however, every effort is to be directed towards preventing or arresting hemorrhage, and favoring speedy cicatrization of the internal wounds. The same principles should govern the surgeon in the treatment of *mediastinal wounds* attended with much bleeding, but without associated heart lesion. Stimulation if resorted to at all, must be so with great care and judgment. At a later period, if pericarditis and endocarditis are developed—and, while frequent, such inflammations are not necessary consequences of the injury—they are to be treated in the usual way.

Gunshot Injuries of the Abdomen.

As the result of gunshot injury, there may be produced in this region (1) contusion ; (2) parietal wound ; and (3) penetration of the cavity, with or without visceral lesion—the missile either lodging in the abdomen, or perforating the cavity to emerge through a second external orifice, or to be arrested at some point beneath the unbroken integument. There may be associated wound of the chest wall or thoracic cavity above, or of the pelvic cavity below, or of the spine behind.

Contusion may result from the blow of a nearly-spent cannon-shot or shell fragment, or from a grazing bullet, or from the more direct impact of a musket or pistol ball, the momentum of which is insufficient to overcome the elasticity of the skin. When the missile is large, there may be produced only tearing of the superficial vessels, with resulting extravasation in greater or less amount ; or rupture of muscles ; or laceration of the abdominal viscera, especially of the liver or of an enlarged spleen ; or even lesion of the great bloodvessels.

Parietal Wounds.—When there is a *parietal wound*, the bullet may lodge at no great distance, or may cut across the wall, or may form a longer or shorter seton track, or being deflected may run around, to emerge or to rest at a point nearly or quite opposite the place of entrance—a round ball, at times, even completely girdling the abdomen. Large vessels may be injured, or the peritoneum bruised, or, though rarely, the kidney or an uncovered portion of the intestine damaged. It is even possible that a pre-existing hernia may be wounded, as in a case reported by Medical Inspector Gihon, U. S. N. In both contusions and non-penetrating wounds, especially when there has been extensive extravasation, parietal abscess frequently results.

Penetrating Wounds.—When the serous membrane is pierced, the ball may glide over the contained viscera without wounding them. On theoretical grounds the possibility of such an occurrence has been denied, but the fact that it does take place has been amply established by post-mortem examination.[1] (See Fig. 298, page 202.)

Fig. 278.

Loops of ileum with shot-perforations. (A. M. M., Spec. 1231, *a.*)

Ordinarily, in penetrating wounds of the abdomen resulting from gunshot injury, lesions of the hollow or solid viscera, or both, are produced, and multiple wounds of the intestinal coils are frequent.[2] Protrusions of healthy or damaged omentum, or of bowel, may quickly occur, though bullet wounds are not likely to be followed by such complications. Injured portions of even the solid viscera (liver, kidney, rarely the spleen), may appear externally. As the result of early fixation of the damaged intestine, an *artificial anus* may ultimately be established, either with, or, as is much more usually the case,

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[1] In his address before the surgical section of the American Medical Association, at Richmond, Va., in 1881, Dr. Hunter McGuire reported four such cases that had come under his own observation.

[2] Longmore reports a Crimean case in which, upon autopsy, it was found that "sixteen openings had been made in the small intestines by the bullet," which "entered near the umbilicus and passed out close to the scrotum," the man having been hit "while stooping in the act of defecation." In the case of the late J. Fiske, Jr., there were "four perforations of the small intestine, two of the large, and fourteen perforations or distinct wounds of the peritoneum." (Peugnet.)

without a projecting *éperon* or spur. A hernia may be found at the opening made for the extraction of the lodged ball. When the diaphragm has been perforated, the protrusion may be into the thoracic cavity, or, as we have already seen, it may show itself through an external chest wound. The bullet may primarily enter and lodge in the stomach or bowel, to be soon discharged *per anum* (in fourteen hours in one of Lidell's cases), or may subsequently, by ulceration and absorption, work its way through the intestinal wall, generally that of the colon, and after a number of days be voided at stool. Encapsulation may take place even in one of the solid viscera.

DIAGNOSIS OF ABDOMINAL WOUNDS.—Though the likelihood of penetration having occurred is much greater here than in a wound of the head or chest, the diagnosis cannot certainly be made by the apparent line of direction of the shot, nor even by the resulting shock or the functional visceral disturbances. As has already been mentioned, there may have been deflection of the bullet, and thus only a parietal injury may have been inflicted.

Shock, though of more probable occurrence in lesions of the peritoneal, than in those of any other cavity, may be noticed in high degree when only a comparatively superficial abdominal wound has been received, and is, on the other hand, at times absent when a fatal visceral perforation has taken place. The results of *hemorrhage* from one of the larger secondary parietal vessels may be mistaken for it. Vomiting of blood, or hemorrhagic discharges from the intestinal canal, may be consequent upon a simple and soon-recovered-from contusion, and a similar injury along the course of the urinary track may be followed by the appearance of blood in the urine; though if the hemorrhage in any of these cases is in large amount, the probability of visceral wound is very strong. When the diaphragm has been involved in the injury, and hernia has taken place through it, there will generally be little or no contraction of that muscle on the wounded side. If, in a case of contusion, *meteorism* quickly follows, that symptom very strongly indicates rupture of the bowel. Early and persistent, *subnormal temperature* renders it very probable that there has been grave organic lesion. The only positive evidences of penetration, however, are furnished by the outflow of the contents of the stomach or bowels, of bile, or of urine; by protrusion; or by seeing or feeling the parts within the peritoneum.

PROGNOSIS.—The prognosis in the *non-penetrating injuries* met with in time of war, while of more gravity than in like wounds of the head and chest, is yet favorable,[1] though death may result from peritonitis, or, rarely, from hemorrhage or other wound complication. In civil life, in which, because of the ordinarily less size and velocity of the missile, peritoneal or bowel injury is very much less likely to be produced, the mortality is much smaller; so much so that, speaking generally, it may be said that, under these circumstances, recovery is almost certain to take place.

Fig. 279.

Gunshot perforation of stomach; *a*, wound of entrance; *e*, wound of exit. (A. M. M., Spec. 3749.)

Penetrating wounds, on the other hand, are most dangerous, 87.72 per cent. of those occurring in our late war having proved fatal (3008 out of 3429 determined cases), as did 91.7 per cent. (111 out of 121) of the French, and 92.5 per cent. (111 of 120) of the English cases in the Crimea. When involv-

[1] Otis reports a mortality-rate of 8.07 per cent.: 253 deaths out of 3134 determined cases.

ing the *stomach* or *small intestine*, these wounds may always be expected to cause death, generally from peritonitis following extravasation, or from very acute septicæmia. Otis declares that " the unequivocal recoveries from shot wounds of the stomach, with or without fistula, number only six or seven" —fistula having occurred but twice, in the case of Alexis St. Martin, and in that reported by Baron Percy; and the same authority doubts if during our war there was a single "incontestable instance of recovery" from wound of the small intestine, though in five cases that got well there was more or less "plausible ground for suspecting" that the lesion was of such a nature. The

Fig. 280.
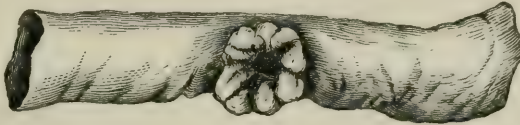
Jejunum perforated by a pistol ball, showing eversion of mucous membrane. (A. M. M., Spec. 841.)

records of military surgery certainly furnish but very few cases of recovery from gunshot perforation of this part of the bowel. If the wound has been made by a small pistol ball, as it is likely to be in cases occurring in civil life, the opening may be so small that escape of fluids may at first be prevented by an eversion of the mucous membrane of the gut, aided by the temporary paralysis of the damaged part of the tube, which is produced by the blow, and thus time may be afforded for the formation of adhesions that shall protect the general peritoneal cavity.

The prognosis in injuries of the *large intestine* is much more favorable, particularly when it is the ascending or descending part of the colon that has been wounded. In at least 20 per cent. of the cases of this nature tabulated by Otis, recovery took place, stercoral fistula having been formed in a large proportion, but having, in most instances, become spontaneously closed in the course of a few months. In many of these non-fatal cases, the wound, it is probable, was in an uncovered part of the bowel, so that in reality the peritoneal cavity was not opened; and it is in this opening of the peritoneum, with the resulting inflammation, or, much more rarely, large hemorrhages, that lies the excessive danger of intestinal wounds.

Fig. 281.

Section of liver showing gunshot perforation of right lobe. (A. M. M., Spec. 1232.)

When the *liver* has unquestionably been wounded, as proved by the escape of bile, or by the protrusion of a part of the organ, though death is very apt to occur, from hemorrhage, from hepatic abscess, or from peritonitis, yet recovery may take place. In at least 14 of the 59 uncomplicated cases analyzed by Otis (23.7 per cent.), and in 18 of the 111 cases in which there were associated lesions of other important parts, and of which the terminations were ascertained (16.2 per cent.), the patients did not die; and it is quite possible that in a number of the thirty other cases of recovery from supposed liver wounds, the organ was really damaged. Even when the *gall-bladder* has been injured, a fatal result is not inevitable,[1] though almost certain to occur from extravasation

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[1] In at least one case, that of Paroisse, a bullet has been found in the cavity of the gallbladder, death having occurred long after the receipt of the injury, and from a totally independent cause.

and consequent peritonitis. The much more rarely observed wounds of the *spleen* are at times recovered from, but are usually followed by mortal hemorrhage. As in the case of the liver, protrusion of a part of the viscus does not necessarily prevent a favorable termination. Though it is true that the existence of a wound of the *pancreas* can generally be ascertained only upon autopsy, and though such a lesion must usually be associated with other very serious if not mortal injuries, yet, if hernia should take place, it need not necessarily add materially to the gravity of the prognosis, since the protruding part of the pancreas may be successfully removed, as was once done during our late war.

Kidney lesions, which are often associated with injury of the spine, or of some other of the solid or hollow viscera, though rarely followed by intra-

Fig. 282.   Fig. 283.
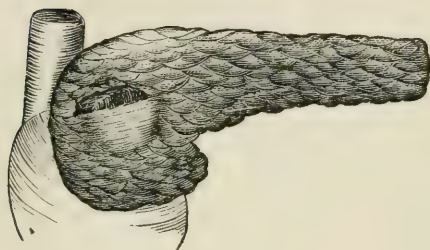
Pancreas with conoidal musket ball embedded.
(A. M. M., Spec. 2884.)
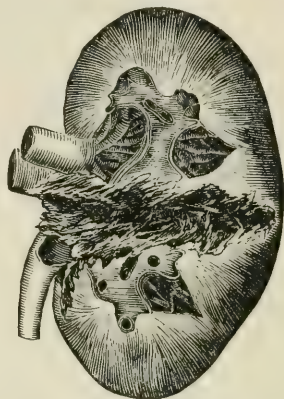
Gunshot perforation of kidney. (A. M. M.,
Spec. 1773.)

peritoneal extravasation of urine, yet generally cause death, from shock, from hemorrhage, or from extra-peritoneal abscess. Recovery however may take place. A number of non-fatal cases have been reported, but in a considerable proportion of them there is more or less reason for doubting the correctness of the diagnosis. In a Crimean case, observed by Legouest, in which the bullet had passed through the middle of the kidney from before backwards, it was found upon making an autopsy that " the organ was much diminished in size, and presented in the centre of each surface a firm, fibrous, depressed cicatrix, to which there were attached like the rays of a star five other irregular cicatrices."

TREATMENT OF GUNSHOT WOUNDS OF ABDOMEN.—The treatment of *non-penetrating* abdominal injuries must be conducted on general principles: foreign bodies are to be removed, when it is practicable to do so; hemorrhage is to be arrested—by ligation, if the bleeding is from one of the larger vessels; collections of blood, if not duly absorbed, are to be freely laid open, to prevent the formation of abscesses with resulting danger to the peritoneum, either from extension of inflammation by contiguity, or, what however rarely occurs, by the discharge of pus into the cavity; extreme quietude is to be maintained; and a strict diet enjoined. If the *kidney* has been wounded, free drainage must be secured, and any external collections of urine or pus which result, must be early and thoroughly evacuated. By the judicious administration of opium, by cold applications, and by bandage compression, peritonitis may be prevented or largely controlled.

In *penetrating* wounds, surgeons have until recently been content to apply cold; to put on a bandage—even of plaster of Paris (Neudörfer); to maintain absolute rest; to prescribe a sparing liquid diet, and opium internally, until the inflammation has subsided. The administration of morphia has been pushed to such extremes that in many cases it has become a serious question whether death has resulted from the wound or from the treatment. But the excessive mortality of these injuries from hemorrhage, from acute septicæmia, or from rapidly developed, intense peritonitis, certainly indicates that something more should often be done, and this "something" must be in the way of operative interference. The experience of the last twenty years has clearly demonstrated that the laying open of the peritoneum is not as dangerous as had previously been thought; that this serous membrane is a great lymph sac that will absorb septic material most readily and rapidly; and that for the prevention of a fatal result from such absorption, drainage must be secured. Whenever then the symptoms clearly indicate that extensive bleeding has recently occurred, or is still taking place; that the stomach or intestine has been opened; or that there has been an intra-peritoneal extravasation of urine or of bile — it certainly seems to be proper, and the surgeon's duty, to perform laparotomy, turn out all clots, tie such divided vessels as can be found, sew up the opening or openings in the intestinal tube, thoroughly cleanse the cavity, and provide for the ready outflow of any fluid that may afterwards be poured out. As declared by McGuire, "If it is urged that the means suggested are desperate, it can be said in reply that the peril is so extreme that, as now treated, nearly all die; and I believe, by the means I have pointed out, in gunshot wounds of the peritoneum, the patient will exchange an almost certain prospect of death for at least a good chance of recovery."

Fig. 284.

Lembert's suture

In closing wounds of the stomach or intestines, the ordinary continued suture (Fig. 211, page 29) may be employed, or preferably that of Lembert (Fig. 284) or that of Gély (Figs. 285, 286, 287). Whether or not the edges are freshened, is pro-
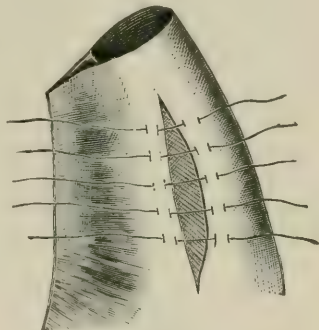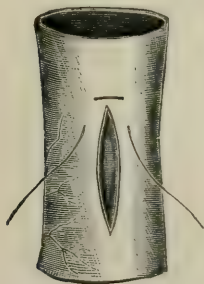
Fig. 285.   Fig. 286.   Fig. 287.
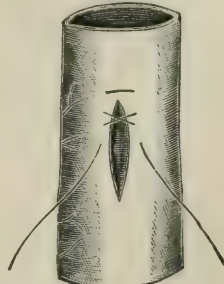
First, second, and third steps of application of Gély's suture.

bably a matter of little or no importance, since the union must take place between apposed serous surfaces. Silk or catgut sutures may be employed, the latter having the advantage of ordinarily entirely disappearing, but the

disadvantage of, at times, melting down before the union is sufficiently firm to be permanent.

If protrusion of an *uninjured portion of omentum or bowel* has occurred, and the case is seen when the parts are only congested, the hernia should be reduced, the parietal wound being enlarged if necessary, and being afterwards firmly closed by compression or with stitches, so as to prevent reprotrusion

Fig. 288.
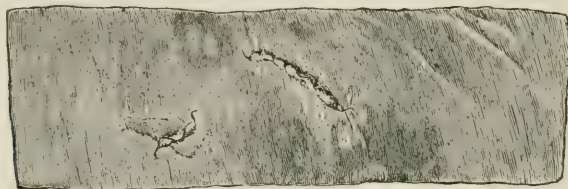
Gunshot perforations of ileum closed with sutures. (A. M. M., Spec. 4390.)

which is otherwise very likely to occur. If *strangulation* has taken place, the knuckle of intestine is to be returned within the cavity, or not, according as its vitality is or is not likely to be maintained; the omentum should be left in place, though the great mass of the protrusion may very properly be ligatured and cut away. This plan of treatment should also be adopted in cases of hernia of portions of the liver, spleen, kidney, or pancreas.

When an *artificial anus* has been formed, an attempt should always be made to close it, since, even if the operation should be unsuccessful, there will generally follow a marked reduction in the size of the opening, and the after condition of "fecal fistula" will be much less annoying. If necessary, the intestinal ends may be retrenched, and then sutured together,[1] or the upper end

Fig. 289.   Fig. 290.
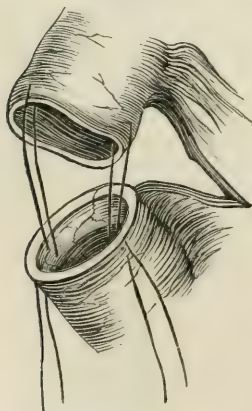
Suture of bowel by Jobert's method; the threads are in place, and the mesentery dissected preparatory to invagination.
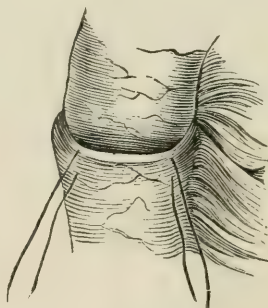
Upper end of bowel invaginated within inverted lips of lower end. (Jobert's method.)

may be simply invaginated within the lower, as in Jobert's method (Figs. 289 and 290). If an *éperon*, or spur-like septum, is present, which is much less

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[1] In a case reported by Kinloch, of Charleston, S. C., in which this was done, half an inch on one side of the opening and two inches on the other having been removed, the continuity of the bowel was in a week later so well re-established, that the patient had a feculent stool *per rectum*, though this channel had been previously unused for seven months.

likely to be the case than when the artificial anus is due to causes other than gunshot injury, it must generally be destroyed; and use may then often be advantageously made of some form of enterotome or compressor, such as Dupuytren's (Fig. 291) or Gross's (Fig. 292).

Fig. 291.
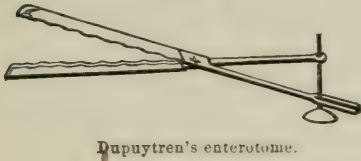
Fig. 292.

Dupuytren's enterotome.
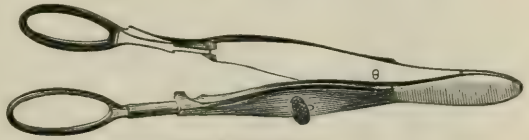
Gross's enterotome.

GUNSHOT INJURIES OF THE PELVIS.

In wounds of this region, damage may be done only to the external soft parts; or there may be associated injury of the innominate bone or sacrum, with or without penetration of the pelvic cavity; or penetration or perforation may occur without any accompanying bone lesion. Not infrequently, the wound involves also the abdomen or the genitals. Lodgment of the missile often takes place—in the thick external muscular mass, in the bone, somewhere in the cavity, or even in the bladder or rectum. As the result of shell injury, great destruction of the overlying soft parts is produced, at times in non-fatal cases; and frequently extensive shattering of the ilium is to be noticed, even in wounds from musket balls.

Lesions of the *bladder* may be expected to be followed by urinary extravasation, intra- or extra-peritoneal according to the location of the vesical opening; a bullet, or a piece of bone, may, however, ultimately work its way by

Fig. 293.
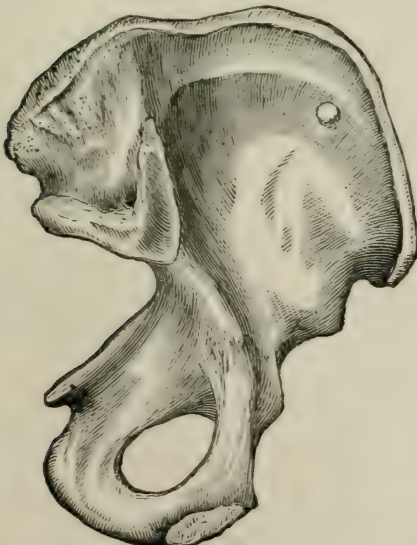
Fig. 294.

Gunshot perforation of left ilium.   (A. M. M., Spec. 2217.)

Gunshot perforation of bladder.   (A. M. M., Spec. 510.)

ulceration and absorption into the cavity, without there having been any escape of urine. Contusion of the hypogastrium may cause temporary paralysis of the bladder, or even permanent incontinence, as in the case reported

Fig. 295.
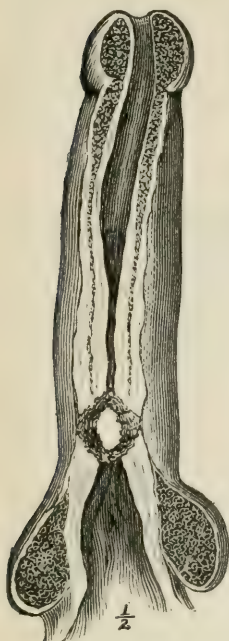
Gunshot perforation of penis, dividing urethra. (A. M. M., Spec. 902.)

Fig. 296.
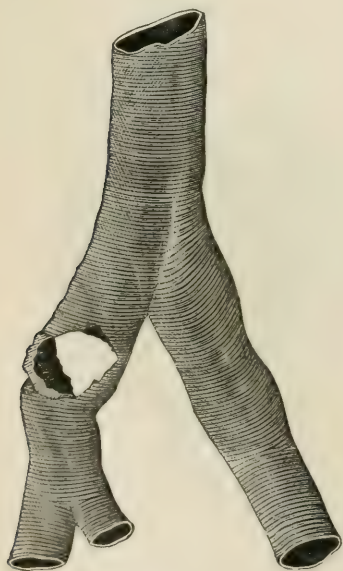
Gunshot perforation of right common iliac artery. (A. M. M., Spec. 6336.)

by Williamson. When the *rectum* has been opened, fecal matter may pass into the peritoneal cavity or the connective tissue of the pelvis, or may be discharged externally, according to the position and extent of the wound. Not very seldom there is simultaneous perforation of both bladder and rectum; or at a later period a communication may be established between these viscera by sloughing.

Injuries of the *male generative organs*, which are fortunately not very common, may be either superficial and slight, or may involve the testis, penis, or spermatic cord. The *testis* may be bruised, torn, or completely carried away, and in cases of other than entire destruction atrophy is the usual result of the lesion; much less frequently, severe and long continuing neuralgia is produced. At times, the shot buries itself in the scrotum. The *penis* may be perforated, or penetration may occur with lodgment of the shot, which, if unremoved, may become encysted. The urethra, which is very apt to be involved, may be contused or lacerated, the injury ultimately resulting in the establishment of a very troublesome fistula, penile, perineal, or rectal, or in the formation of a stricture. Occasionally a ball, even of large size, will be found to have passed through the corpora cavernosa or the glans without damaging the urethra.

Wounds of the *female genitals* are rare, and usually associated with other and much more important lesions of the abdominal, pelvic, or femoral regions. The *uterus* is not often injured; when in the unimpregnated state, but little harm may be done beyond that resulting from the commonly associated vesical and rectal wounds; but when, on the other hand, pregnancy exists, there is much risk of an early and fatal termination of the case, from the abortion which must almost of necessity occur, or from hemorrhage, shock, or peritonitis. Death, however, may not take place; and even an injured fœtus may be born alive, if we can credit such a report as that given by Reichard.[1] A more or less permanent fistula may remain after an otherwise complete recovery from a penetrating uterine wound, through which the menstrual blood may be discharged.

The great *bloodvessels* of the region (iliac, gluteal, sciatic, pudic, or obturator) may be primarily divided, or secondarily opened by ulceration, after contusion; and traumatic aneurisms are at times developed. The large *nerves* (the sciatic within or without the pelvis, the anterior crural, the obturator) may also be injured, with resulting paralysis or neuralgia.

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[1] In this case the child had a wound under the right clavicle, in which there was lodged a piece of the mother's clothing, and a buckshot of the size of a small pea.

DIAGNOSIS OF PELVIC INJURIES.—The only doubtful point, as a rule, in regard to diagnosis, is whether or not there has been perforation of the rectum or bladder, or both; and here, as in abdominal wounds, reliable evidence is furnished solely by the escape of the contents of the injured viscus —that is, of fecal matter or of urine. Whether or not the bladder is wounded, depends, in great degree, upon its full or empty condition.

PROGNOSIS OF PELVIC INJURIES.—The prognosis in injuries of this region is largely affected, of course, by the presence or absence of fracture or penetration. Flesh wounds, though they may cause death from hemorrhage, are, even when very extensive, not likely to terminate fatally, though they are not infrequently followed by decided functional impairment from muscular injury and cicatricial contraction. When fracture has taken place, the gravity of the injury is much increased; since, aside from the effects of the often-associated visceral lesion, the patient is subject to all the risks arising from prolonged suppuration and septic infection. Of the cases observed during our late war, those of fracture of the ilium were the least fatal—the expanded wing of that bone being at times bored through without serious damage being done—and those of the pubis the most so; the relative order being: ilium, 24.42 per cent.; coccyx, of which, however, only seventeen cases were reported, 35.3 per cent.; ischium, 42.4 per cent.; sacrum, 43.7 per cent.; pubis, 50 per cent. When the shot passes through the thick gluteal mass, there is often much difficulty in securing free drainage, and, as a consequence, danger to life is proportionately increased. In the cases that recover, healing ordinarily takes place slowly, and extensive necrosis or caries is likely to occur, especially when the bullet has lodged. When the shot has passed through the pelvic cavity, though it may, particularly if small, occasionally do no serious damage, yet usually visceral lesion is produced; but the mortality of such wounds is very much less than that which attends perforations of the abdomen, the probabilities of being able to secure free drainage being very much greater. Of 183 cases of bladder wound analyzed by Otis, 96, or 52.46 per cent., ended fatally, as did 44 of 103 cases of wound of the rectum, or 42.7 per cent.; in 34 of the rectal injuries, the bladder was also wounded, 14 of the cases proving fatal, or 41.17 per cent. When the bladder has been so wounded as to cause intra-peritoneal extravasation of urine, death is almost certain to occur, under the ordinary plans of treatment, from hyperacute peritonitis; and the same is true when fecal extravasation takes place through a rectal wound high up.

If recovery takes place after these visceral lesions, fistulæ, strictures, or functional disturbances often remain. Very troublesome effects are at times produced by the entrance of pieces of clothing, wadding, or bone-fragments into the bladder or rectum, especially the former, or by the late consequences of necrosis. Foreign bodies may, in time, work their way out through the wounds or the natural passages; but osseous spicula, and particularly missiles, projecting into or free in the vesical cavity, may be expected to become incrusted with phosphates and to form the nuclei of calculi, which, occasionally, do not manifest their presence until years after the receipt of the wound. In at least sixteen cases of gunshot injury, stones have been formed upon bone-fragments, and in certainly thirty-three cases, the bladder has been opened and bullets or shell-fragments removed. In *genital wounds*, death, when it occurs, is usually due to other associated lesions; of the cases reported during our war, the mortality rate was: for wounds of the testis, 66 out of 586, or 11.26 per cent.; for those of the penis, 41 out of 309, or 13.27 per cent.; and for those of the urethra, 22 out of 105, or 20.95 per cent. *Extravasation of urine* following gunshot wounds of the urethra, like that following

injuries of other kinds, may be in large amount, with corresponding extensive destruction of tissue, or in limited quantity, with resulting abscess and fistula. When the large intra-pelvic *bloodvessels* are primarily opened—and this is more likely to happen in civil than in military practice, the wounds being made at shorter range—speedy death generally occurs, and the same result is very likely to follow similar injuries of the gluteal and sciatic vessels at or near their points of emergence. Secondary hemorrhage from ulceration may occasionally—though, unfortunately, not very often—be controlled by pressure or ligation, and the patient saved.

TREATMENT.—The treatment of *external* pelvic injuries is to be conducted on general principles: hemorrhage being controlled by compression or ligation; all foreign bodies, particularly detached bone-fragments, removed if possible; drainage secured; pus-collections opened; and rest maintained. Sequestra are to be taken away as they become detached, and carious parts may often be advantageously removed with the gouge. When *penetration* has occurred, bullets, clothing, wadding, and spicula, driven in by the shot, are to be removed as they can be found. If the *rectum* has been wounded, much benefit will often result from free division of the sphincter, as recommended by Dupuytren. Extra-peritoneal *effusions of urine* are to be evacuated by perineal incisions, and a catheter should be carried through the urethra into the bladder and there retained; all abscesses are to be early and freely opened. When the vesical wound is so located that the urine escapes into the peritoneal cavity, death, as we have already seen, quickly takes place from peritonitis; and treatment by catheterization, with or without perineal section, cannot be expected, except by the merest good fortune, to avert the fatal result. Vincent has lately shown experimentally that recovery might be hoped for from laying open the abdomen and closing with sutures the wound in the bladder; and such an operation, together with, if necessary, the establishment of a connection with the rectum near the bottom of the recto-vesical pouch, would be certainly justifiable.

When the *scrotum* has been contused, or only superficially torn, no special treatment is required; any resulting inflammatory or purulent collections should be opened early. A wounded *testis*, even if extensively lacerated, should not be removed, since a portion of the organ may be ultimately saved, and the danger to life from expectant measures is less than that from operation— 11.9 per cent. as against 18 per cent. in the cases treated during our war. When the *penis* has been wounded, treatment must be directed to the arrestation of hemorrhage, the prevention of urinary retention or extravasation, the preservation of every portion of the organ that can be saved, the controlling of the erections (which are, at times, excessively painful), and the correction, at a later period, of cicatricial incurvations arising from unilateral loss of substance. Hemorrhage, much more likely secondary than primary, is to be checked by ligation, if the dorsal artery has been divided, or, under other circumstances, by compression or the introduction of stitches, a catheter being kept in the urethra; or even by styptics. Whatever the part of the organ that is damaged, except when the wound involves only the skin, a soft catheter should for some days at least be kept in the bladder; and especially should this be done when the urethra has been divided, if it is not, as occasionally happens, impossible to introduce the instrument. If urinary infiltration occurs, it must be at once relieved by incisions. Retention, when catheterization cannot be effected, can always and safely be treated by supra-pubic aspiration.

Amputation of the penis should not be performed, even if the organ has been almost completely cut through; for by the application of stitches the

parts may be so held together that at times union will result; as in the case reported by Baudens, in which "the cavernous bodies and the urethra, entirely divided, were held only by a portion of the integument." The always troublesome and often very painful erections must be controlled as much as possible by the usual remedies—opium, camphor, the bromide of potassium, etc. Cicatricial curvatures, which more or less seriously interfere with the functional integrity of the organ, if they cannot be prevented by appropriate dressings during the stage of healing, may be in greater or less measure corrected by removal of the cicatrix, if superficial and occupying the dorsum of the penis, or, when laterally placed, by excision of a wedge-shaped piece from the opposite uninjured corpus cavernosum. Urethral fistulæ and strictures should be treated in the usual way. When the abnormal openings are located in the penile portion, particularly near the peno-scrotal angle, or in communication with the rectum, failure is not unlikely to follow any attempt at closure.

For the arrestation of *primary hemorrhage*, if from even the large arterial or venous trunks—should cases of such come under treatment—ligation is always to be employed when practicable; the only exception to this rule is, perhaps, when the wound is of the gluteal artery, in the external part of its course, when properly applied compression may be used instead. Frequently it will be found very difficult, if not impossible, to determine from what source the bleeding comes; for instance, if the ilio-lumbar artery has been wounded, as in cases observed by Hodgen and Desprès. If an *aneurism* has formed, the sac may be opened and the vessel tied above and below, hemorrhage at the time being prevented by pressure on the vessel higher up, or by the use of an aorta compressor or a Davy's rectal lever. *Secondary hemorrhage*, whenever it is possible, should be treated by the application of ligatures above and below the seat of injury. Unfortunately, neither ligature nor compress succeeds in the majority of cases in saving life, and this whether the hemorrhage be primary or secondary. Not once after gunshot injury has a ligature been successfully applied to the common iliac artery. Every case of wound of the sciatic artery, during our war, terminated fatally, as did fourteen out of eighteen of those of the gluteal, two only being saved by ligation and two by compression. Of the sixteen ligations of the external iliac artery, only two ended in recovery.

Gunshot Injuries of the Vertebræ.

Gunshot injuries of the spinal column may produce contusion, fracture, or penetration of the canal, and are often associated with lesions of important structures in the neck, chest, or abdomen. *Contusion* may be caused by the blow of a large missile, with or without accompanying wound of the soft parts, or by a bullet, the momentum of which is so far destroyed that it is unable to break the bone. *Fracture* may affect either the processes or the body of a vertebra, and in the latter case the shot may either penetrate or perforate, producing very frequently fissures running through to the posterior surface. When the cervical or dorsal canal is *penetrated*, the cord is usually, though not necessarily, damaged, and the associated injury to the bony wall may be limited to one of the vertebral laminæ. *Hemorrhage*, either outside or inside of the theca, may be associated with any of the forms of vertebral injury; and the same is true of *nervous disturbances*, such as pain (near or remote), tingling, reflex movements, and impairment—sometimes extending even to complete though temporary abolition—of motion and sensation. Laceration or division of the medulla must, of course, be followed by *paralysis*,

more or less complete, according to the locality and extent of the injury; and similar effects, confined to a limited area, may be due to lesion of a nerve soon after it has left the cord. At times, injury is done not by the missile itself, but by bone-fragments, detached or adherent, driven in by the shot.

Fig. 297.
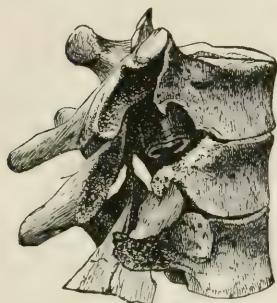
Fig. 298.

Eighth, ninth, and tenth dorsal vertebræ, with conoidal ball in vertebral canal. (A. M. M., Spec. 2939.)
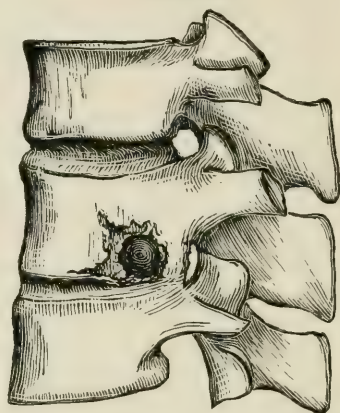
Round musket-ball lodged in second lumbar vertebra, after traversing abdominal cavity without injuring the viscera. (A. M. M., Spec. 3349.)

Meningitis, or *meningo-myelitis*, is the almost necessary consequence of any spinal injury other than the slightest, and is the chief cause of death in cases that survive the first few days after the receipt of the wound. A chronic form of inflammation may result even from contusion; but in most cases of the latter injury, the cord lesion is limited to concussion, which ordinarily is quickly recovered from.

DIAGNOSIS OF SPINAL INJURIES.—That a vertebral wound has been received, is indicated by the apparent line of direction of the shot, by the resulting shock, by the development of nervous disturbances, by the discovery upon exploration of broken bone, and by the detection of such associated displacement as is pathognomonic of a fractured spine however produced. The first of these indications has no value except as confirmed by the others, since deflection may and often does occur, particularly if the missile is small; and the second is little if any more reliable, since shock may be very slight, as at times when a spinous process is broken, and, on the other hand, it may be present in an extreme degree when the shot, passing near to but not impinging on the spine, has wounded important organs in its vicinity. Nor can paralysis or pain, whatever their character, location, or degree, be accepted as proof positive of fracture; pain may be due simply to contusion, or may be altogether absent (except such pain as may follow the receipt of any gunshot wound), particularly when it is a spinous process that has been broken. The existence of the latter form of injury can usually be readily ascertained by manipulation, both preternatural mobility and crepitus being detected. Escape of the cerebro-spinal fluid is usually associated with, and so far indicative of, injury of the cord; but such an outflow may take place when only the sheath has been opened.

Actual lesion of the cord from concussion, from compression, or from laceration by bone or ball, is always, except occasionally when the injury is in the lumbar region, followed by disturbances of sensation and motion, of the same character as those resulting from spinal irritation, inflammation, or disorgan-

ization after ordinary traumatisms. Pain, at times excruciating, may be present at the seat of injury, girdling the body, following the course of particular nerves, or confined to a limited area in a remote part; the sensation is not infrequently that of burning or tingling, or, on the other hand, there may be numbness or even complete anæsthesia. Similarly, the motor disturbances may be those of excess or diminution of action—twitchings, jerkings, tetanic spasms, or, what is much more usually seen, paralysis, partial or complete, below the seat of injury, transitory or permanent according to the condition of the cord—accompanied by muscular atrophy, most strongly marked in the leg muscles after lumbar injury. In cervical and dorsal wounds, the voice, respiration, and circulation are affected, in greater or less degree, according to the location and extent of the injury. Rectal and vesical paralysis, with subsequent incontinence, are ordinarily present if the cord-lesion has been at all extensive. In the male, priapism is an often-observed, but not necessary, symptom of injury above the third lumbar vertebra, its frequency of occurrence increasing as the wound approaches the top of the column. In cervical lesions, high up, seminal ejaculation is apt to take place at the time of injury, even when the wound causes immediate death. As in all other spinal injuries, bedsores are usually formed in cases that do not speedily prove fatal, and are likely to be developed very quickly.[1]

PROGNOSIS.—The prognosis of vertebral injuries, aside from the less severe forms of contusions and fractures of the processes, especially the spinous, is very grave, death usually resulting from lesion of the cord, from septic infection, from caries with abscess, or from associated wound of a viscus or large vessel. As was declared by Ollivier, in gunshot cases the accidents are graver, and death generally more rapid, than in those otherwise caused. Of the 32 cases of vertebral fracture among the British soldiers in the Crimea, all proved fatal except four, "which were either fractures of the transverse processes in the neck, or of the spinous processes only," and in the French army, 181 died out of 194 (93.3 per cent.). In the war between Prussia and Hanover, in 1866, there were eight cases with six deaths. Of 628 cases tabulated by Otis, 349 or 55.57 per cent. ended in death, the mortality according to locality having been: for the cervical region, 70 per cent. (63 out of 90); for the dorsal region, 63.5 (87 out of 137); and for the lumbar region, 45.5 per cent. (66 out of 145); but in almost all, probably, of the non-fatal cases, the fractures affected only the processes. Of the subjects of lumbar injuries, 79 recovered, but it is expressly stated that "there were more than seventy recoveries after gunshot fractures of the apophyses of the lumbar spine." In Circular No. 6, S. G. O., 1865, it is reported that "of 187 recorded cases of gunshot fracture of the vertebræ, all but seven proved fatal; six of these were fractures of the transverse or spinous apophyses." Of 54 cases in which it is known that there was an associated injury of the cord, 42 died (77.78 per cent.).

In very many of the military cases, death occurs so speedily that the individuals never come under observation. How quickly life may be destroyed is indicated by the fact that in a case of pistol-ball wound between the axis and atlas, the victim, who was asleep, was not startled by the noise of the firing, and never moved a limb.[2] The lower down in the column that the wound is, the longer of course the patient may be expected to live. Even when there has been a primary, complete division of the cord, the fatal ter-

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[1] In a case observed by Guersant, in which the ball passed through the body of the eighth dorsal vertebra, a sacral bedsore formed on the third day.

[2] Specimen in Middlesex Hospital Museum.

mination may be delayed for hours or days, according to the wound's location. In injuries of less severity, affecting the medulla, its coverings, or the vertebral bodies, though death is very probable, it is not inevitable, and is less to be apprehended in cases occurring in civil life than in those met with in military practice, since the missiles used in civil life are ordinarily smaller. Complete restoration to health, in cases other than those in which the processes only are affected, rarely occurs, more or less nervous disturbance (pain, weakness, or positive paralysis) usually remaining during the after-life of the individual, with perhaps caries and abscess, or fistulæ communicating with dead bone. When the injury has involved only a spinous process, and there has been no associated damage of the cord—which is frequently, if not generally, the case—the chances of recovery are very good. Even when the body of a vertebra has been broken—and under such circumstances considerable comminution may be expected to occur—if there has been no lesion of the cord or theca, other than perhaps a limited extravasation of blood outside the sheath, or a concussion of the medulla, the individual may not only not die, but may recover, and with very little after-disturbance, organic or functional.

In a case reported by Keen, a conoidal ball entered through the right upper lip and lodged in the body of the third cervical vertebra, from which place it was extracted six weeks later. The paralysis which had affected all four limbs was rapidly recovered from. Five weeks after the removal of the bullet, there was spontaneously discharged "nearly the entire body of the third cervical vertebra, including the anterior half of the transverse process and the vertebral foramen." Nearly eight years afterwards the man was living, having his "right shoulder and arm diminished in size and partially paralyzed."

Such a fortunate result, however, occurs only in young persons or in those not beyond middle life. *Contusion of the bone* may be followed by temporary and quickly recovered from general disturbance, or, after a few days, may give rise to meningo-myelitis, soon terminating in death; but inflammation is much less likely to occur here than in the head after cranial contusions, on account of the greater protection afforded by the subarachnoid fluid. Wounds of nerves close to the intervertebral foramina, will be followed by serious effects, motor and sensory, in the parts which they supply; and even concussion may give rise to paralysis and atrophy, the latter especially being likely to remain for a considerable time, if not permanently.

TREATMENT.—The special treatment of spinal injuries produced by gunshot has reference only to the removal, when practicable, of foreign bodies, such as balls, bone-fragments, shreds of clothing, etc. The wound should be explored as early and as thoroughly as possible by the finger, if it can be used, if not by the probe, in order that the presence or absence of fracture may be determined. Loose pieces of bone and clothing are to be taken away, and, if detected, the bullet also, provided that its removal can be effected by the exercise of warrantable force and in reasonable time; otherwise the shot is to be left undisturbed. Under no circumstances should any extensive cutting operation be practised in the search for a ball the location of which has not been ascertained by touch. Formal trephining has not as yet resulted favorably, but decided benefit has in some cases followed the elevation of depressed spinous processes and laminæ. At times, the extraction of the missile may be followed by severe hemorrhage, necessitating the plugging of the wound. If an associated injury of an artery is causing troublesome bleeding, the vessel should if possible be found, and ligatures should be applied on either side of the opening. This complication is however a rare

one: in only seventeen cases of spinal injury during our war was there hemorrhage of any importance—but fourteen of these terminated fatally. In all other respects, the treatment of gunshot spinal injuries is the same as that of like accidents produced by ordinary traumatisms. The maintenance of rest, as absolute as possible, is very essential; and much benefit will without doubt be often secured by immobilization of the spine, preferably by plaster-of-Paris. Dry-cupping, in cases of concussion, and wet-cupping in those in which meningo-myelitis has supervened, have been regarded with much favor by many military surgeons. The bladder should be regularly catheterized; the bowels relieved at proper intervals; and bedsores prevented if possible by the use of the water-bed, by change of position, and by mildly stimulating local applications. Blood-poisoning, so much favored by the nature of the injury of a vertebral body, may perhaps be largely prevented by an antiseptic dressing. Paralysis, not disappearing speedily and spontaneously, should be treated in the usual way.

GUNSHOT INJURIES OF THE EXTREMITIES.

By far the larger part of the gunshot wounds coming under treatment in time of war,[1] and a very considerable though decidedly less proportion of those met with in civil life, are of the extremities; injuries of the lower, are about one-half more numerous than those of the upper extremity, and the general mortality is between 20 and 25 per cent. for the former, and about 12 per cent. for the latter. The left side is more often wounded than the right. As in other regions, the injuries may involve the soft parts only, or the bones and joints may also be damaged—the gravity of any wound being, as a rule, proportionate to the extent of the existing osseous or articular lesion. Joint wounds have already been considered. (See page 153.)

UPPER EXTREMITY.

FLESH WOUNDS of this region, though very frequent,[2] and liable to be followed in large proportion by more or less disabling cicatricial contractions and adhesions, are, when there is no associated wound of the neck or trunk, dangerous to life only as they are very extensive (as for instance when caused by heavy shot, shell fragments, or fowling-piece charges at short range), as they involve the main vessels, or as they are attended by the graver wound-complications.

The *treatment* therefore, aside from that proper for all gunshot injuries—the discovery and removal of foreign bodies, maintenance of rest, moderation of inflammation, relief of tension, drainage of the wound, etc.—has reference to the arrestation of hemorrhage, the meeting of special symptoms as they may arise, and the exercise of such care in dressing as shall prevent or lessen as far as possible cicatricial deformity and false anchylosis. *Divided arteries*, if other than small ones, should be ligated above and below the point of injury; but even when thus treated, the probabilities of such cases terminating fatally are very great.

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[1] Of over 130,000 cases tabulated by Longmore, nearly 67 per cent. were of the extremities—28 per cent. of the upper, and 39 per cent. of the lower; and Otis's table, including nearly twice as many cases more, 360,000 in all, shows that one-third of the entire number were of the upper extremity.

[2] " Over fifty thousand cases, or about a fifth of all the wounded reported *by name*, were returned as shot flesh wounds of the upper extremities." (Otis.)

During our late war, there were 15 ligations of the axillary in cases of flesh wound, with 12 deaths (80 per cent.) ; 76 of the brachial, with 21 deaths (27.6 per cent.) ; 20 of the radial, with 4 deaths (20 per cent.) ; and 10 of the ulnar with 3 deaths (33.33 per cent.).

The large *nerve trunks* are, fortunately, not very often injured (about once in every 600 cases perhaps), but when wounded, though the results are not serious as respects life, they are very grave as regards the after comfort of the individual and the usefulness of the limb.

Occasionally, because of extensive laceration of the soft parts (by shell fragments usually), of sloughing or gangrene of large extent, or of lesion of a main vessel, *amputation*, primary or late, has to be performed. Of fourteen such operations at the shoulder-joint, during our war, eight resulted fatally, or 57.14 per cent. ; of fifty-four of the arm, twenty-seven, or 50 per cent. ; and of fourteen of the forearm, three, or 21.43 per cent. In civil practice, removal of the limb can only be required when a load of shot has been driven through the axillary space, so destroying the vessels and nerves as to render it certain that even if saved the arm must be useless, or because of the supervention of gangrene, or of secondary bleeding that cannot be otherwise controlled.

GUNSHOT FRACTURES.—Occurring much less frequently, but still often, and producing greatly increased risk to life, and far more ultimate interference with the functional utility of the extremity, are cases of bone injury, almost always fracture. *Bone contusion* has but rarely been observed in this situation, either because actually not present, or more probably because overlooked, the effects produced being of a mild character, and being attributed to the injuries done the soft parts. All the varieties of fracture heretofore referred to are met with in this region ; fissures, comminutions, crushings, penetrations, perforations, etc.—but the results of such lesions are not as grave as those of similar injuries in the lower extremity. At times both arms are wounded, or even carried away, by a shot that does not touch the body.

Fig. 299.

Shell-fracture of humerus treated by excision. (A. M. M., Spec. 1738.)

After the battle of Antietam, I saw a young infantryman who, when in the act of firing, was struck by a shell that crushed the left arm and right forearm, necessitating double primary amputation. Similar injuries have been not infrequently observed.

Associated wounds of the neck or trunk are very common, and in such complications are often to be found the causes of death.

Nerves, especially those passing in close relation with the broken bone, and when the fracture is near an articulation, are frequently damaged, with resulting paralysis, atrophy, muscular contractures, pains, or numbness ; and in the majority of non-fatal cases, a large part of the functional impairment met with after these injuries is due to such nerve lesions. In many cases, especially when the nerves distributed to the hand have been wounded, severe and quite persistent *causalgia* has sooner or later manifested itself. *Tetanus* is not very likely to supervene, even in hand injuries, having been met with in but 24 of the over 11,000 cases of this nature reported during our war.

Primary, and still more often secondary, *hemorrhage* gravely complicates many of these cases, and *traumatic aneurisms* are at times developed ; the vascular lesions, too, are often, but much less frequently than in like wounds in

the thigh and leg, the cause of *gangrene*.   Suppuration of the sac is more apt to occur in traumatic aneurism of the axillary artery than in that of any other vessel.

Sometimes, when the shot has produced great destruction of the humerus, or after an extensive exsection in continuity, a *flail-like* condition of the extremity has resulted; but such a "dangle-limb" may yet be quite serviceable, the individual being able, by muscular contraction, to bring up the lower against the upper fragment, and afterwards to execute many movements of the forearm.   *Pseudarthrosis* is very seldom met with; but in the rare cases of simple gunshot fracture of the humerus, false-joint seems very likely to result: there were but five such cases recorded during our war, and in two of these there was non-union.

Prognosis.—The prognosis of gunshot fractures of the arm, though affected, of course, by the character and extent of the osseous lesion, and by any associated injury of the neck or trunk, may be said, in general, to be moderately favorable, and to become less grave in proportion as the wound is located further away from the body: humeral fractures are the most dangerous, while those of the bones of the hand are the least so.

Of nearly twenty-five thousand (24,200) cases analyzed by Otis, the numbers and death-rates were as follows:—

	Cases.	Deaths.	Mortality per cent.
Clavicle	520	44	8.46
Scapula	1423	177	12.44
Clavicle and scapula	103	24	23.3
Humerus	7888	1639	20.7
Radius	1450	115	8.0
Ulna	1568	126	8.0
Radius and ulna.	1288	142	11.0
Bones of hand	9960	316	3.17

As shown by the above table, though injuries of the clavicle or scapula, separately, are less dangerous than those of the humerus, yet those of the two bones together are decidedly more so.   In scapular perforations, much trouble and some danger are likely to be caused by collections of blood and pus, internal to and, from gravitation, below the bone; even lumbar ecchymosis is sometimes thus produced.   The chief causes of death are hemorrhage, exhaustion, and septic infection.   In those non-fatal cases in which the limb is saved, recovery is tedious, and may be expected to be associated, in greater or less degree, with deformity, adhesions and contractions of the muscles and fasciæ, atrophy, weakness, and true, or more often false, anchylosis of the joints. The amount of impairment of functional value will, however, in very many cases, depend greatly upon the treatment adopted, and upon the time at and during which passive and active movements of the injured parts are made, and the extent to which they are carried.

Treatment.—In the treatment of these cases, the first and most important question to be settled is, shall it be by amputation, by excision, or by expectancy?   Primary *amputation* of a part or the whole of at least the *right* upper extremity, should seldom or never be adopted for a bullet-wound, no matter how extensive the shattering caused by the ball; this operation should, in military practice, be reserved for the severer shell injuries, and in civil life, for the similar lacerations produced by shot-charges fired at close range. Even if the brachial artery has been torn, amputation is not imperatively demanded.   Though undoubtedly lives will, at times, be lost in attempts to save limbs, the importance of the arm is so great that it is often permissible to take the increased risk.   Amputation at a later period may be necessitated,

of course, by wound complications; but, with the exceptions already referred to, the operation should be held in reserve as the complement of expectancy.

As based upon a far larger number of cases, and for every reason giving a nearer approximation to the legitimate death-rate of amputations in the upper extremity than the tables compiled chiefly from the Crimean returns, Otis's statistics are here presented.

TABLE SHOWING RESULTS OF AMPUTATIONS FOR GUNSHOT INJURIES OF THE UPPER EXTREMITY.

	PRIMARY.			INTERMEDIARY.			SECONDARY.			UNSPECIFIED DATE.			TOTAL.		
	Cases.	Deaths.	Mortality per cent.	Cases.	Deaths.	Mortality per cent.	Cases.	Deaths.	Mortality per cent.	Cases.	Deaths.	Mortality per cent.	Cases.	Deaths.	Mortality per cent.
Shoulder	485	117	24.44	157	72	45.86	66	19	28.78	119	28	23.53	827	236	28.53
Arm—upper third .	1338	183	13.67	347	108	31.12	173	46	26.59	82	21	25.61	1940	358	18.45
Arm—middle " .	1162	143	12.30	348	93	26.72	162	35	21.60	58	13	22.41	1730	284	16.41
Arm—lower " .	512	106	20.70	161	67	41.61	61	24	39.34	22	0	0	756	197	26.05
Arm—location not stated . .	247	170	68.83	46	34	73.91	15	9	60.	539	194	36	847	407	48.05
Elbow	32	2	6.25	5	0	0	5	2	40.	7	1	14.28	49	5	10.20
Forearm—upper third	296	26	8.77	128	31	24.22	55	9	16.36	10	0	0	489	66	13.50
Forearm—middle "	381	25	6.56	205	41	20.	80	8	10.	9	1	11.11	675	75	11.11
Forearm—lower "	294	28	9.52	100	21	21.	40	6	15.	17	1	5.88	451	56	12.41
Forearm—location not stated . .	36	18	50.	17	13	76.47	9	6	66.67	57	8	14.03	119	45	37.81
Wrist	55	5	9.	7	1	14.28	5	1	20.				67	7	10.45

To which may be added that "6870 cases of ablation of the digits only, gave a mortality of 2 per cent.; 413 cases, in which the metacarpo-phalangeal articulations were interested and ends of metacarpal bones removed, a mortality of 3.2 per cent.; 619 cases, in which corresponding metacarpals were removed with fingers, a mortality of 7.6 per cent." (Otis.)

Early, formal *excisions* in continuity should not be employed, since they are dangerous to life, frequently necessitate after-amputation, and, if of any extent, are very likely to be followed by disabling deformities, or by false-joints, or dangle-limbs. On account of necrosis, however, excision may often, at the proper time, be very advantageously performed, and even an entire bone may sometimes be properly removed.[1]

That the treatment by *expectancy* may result in success, loose fragments must be removed, thorough drainage secured, the limb immobilized, and septic infection prevented. How far the accomplishment of the latter object may require the adoption of a strict "antiseptic treatment," the future must decide.

LOWER EXTREMITY.

FLESH WOUNDS of this region are of common occurrence and of exceptional gravity; they are at times of very large size, as when the thigh or the calf of the leg has been struck by a shell-fragment, or as the result of hospital gangrene. The *main vessels*—femoral, popliteal, or tibial—are frequently involved in the injury, by laceration, or, more often, contusion. Both artery and vein may be simultaneously wounded, or, on the other hand, both may

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[1] It is interesting to notice that, in the only recorded case of complete exsection of the scapula after gunshot injury (F. H. Hamilton's, in 1866), the operation was a late one for necrosis. Early and extensive removal of portions of the shoulder-blade has been practised in quite a number of cases, three times by one operator, Chipault, of Orleans.

escape, though the line of direction of the shot apparently passes directly through them. Bullets, even of large size, occasionally traverse the popliteal space from side to side, without damaging either the hamstring tendons or the underlying vessels. Deep, penetrating or perforating wounds of the upper and posterior part of the leg are very likely to injure one or both tibial arteries, and, as a consequence, such flesh wounds, even when made by small pistol-balls, must be viewed with much solicitude. Whether the thigh or leg vessels are primarily torn or contused, but particularly when damaged in the latter way, their injury is very apt to be followed by secondary bleeding or gangrene, which, as Lidell has put it, "destroys more patients than all the forms of hemorrhage taken together, battle-field hemorrhage excepted."

Fig. 300.

Gunshot laceration of right femoral vein. (A. M. M., Spec. 2094.)

The principal *nerves* of the limb are not seldom wounded, their injuries being followed by the ordinary results of severe nerve-lesions, and in addition, when the sciatic has been divided, at times by gangrene. As has already been mentioned, wound of this nerve was declared by Wyatt to be the special cause of *gangrène foudroyante*, a complication, however, by no means limited to the lower extremity, and not rarely found associated with visceral disease, particularly of the kidney.

In some cases the lesion is not confined to the extremity, but involves also the pelvis or abdomen; frequently a bullet passes through both limbs, and, when it does so high up, the genital organs may be injured at the same time. If there be no serious complication present, the shot-track may be expected to heal in due time; but if the ball has pierced the fascia lata, or the dense aponeurosis of the antero-external part of the leg, it will often be found that, in healing, the fascial opening does not close, and that hernia of the muscle is consequently permitted. Disabling cicatricial deformities are very likely to follow, if there has been any considerable loss of substance, and more or less impairment of motion often results from muscular adhesions.

Fig. 301.

Partially consolidated gunshot fracture of left femur. (A. M. M., Spec. 798.)

GUNSHOT FRACTURES.—When the shot has caused bone injury, the lesion, though occasionally a contusion, is, in the great majority of cases, a fracture, and very rarely of the simple variety. When the missile has struck the lower end of the femur, or, much oftener, the upper end of the tibia, it may penetrate or perforate without splintering. Such a wound was not seldom witnessed in former times, when the round ball was used, but is only exceptionally produced by the modern conoidal bullet, even if of small size. In all such cases observed by Becher, during the Franco-German war, the vulnerating body was a Chassepot bullet. It is possible, but not very probable, that though a shot passing through an articular extremity at the knee may extensively comminute the bone, there may be no apparent change of shape produced, extravasated blood temporarily cementing the fragments together. Lodg-

ment of the missile may take place, much more frequently, in the case of the thigh and leg bones, in one of the epiphyses than in the shaft. Bullets thus lodged, if not removed, though they ordinarily prove a strongly exciting cause of early local mischief, may become encapsulated, and give rise to no trouble; but serious inflammation may be excited by their presence years subsequently.[1] When it is the tarsus that has been wounded, the ball, particularly if a small one, often buries itself in the cancellous tissue, or is wedged between two bones, from whence it may be removed only with much difficulty. In addition to the ordinary longitudinal or spiral fractures of the femur or tibia, there may be a transverse break at some little distance above or below the point of impact, according as the latter is below or above the middle of the shaft. (Otis.)

Pseudarthrosis is of less frequent occurrence, in these cases, than might naturally be expected from the extent of damage done by gunshot violence. Bérenger-Féraud has collected the histories of fifty-six cases of non-union of the femur, and seventeen of the bones of the leg; and believes that such a condition is less often seen after wounds of the lower than after those of the upper extremity (in the proportion of eleven to twenty-four), not because of any difference in the parts themselves, but for the reason that attempts at saving the limb are so much oftener made in injuries of the arm and forearm than in those of the leg and thigh.

The *femur* is, of all the long bones, the one most frequently wounded, and that injury to which is most dangerous to life.[2] At times, when the lesion is in its upper part,[3] the fracture may be readily recovered from with but little shortening or deformity. The causes of the great mortality attending this injury are: the hardness of the compact tissue and consequent extent of the shattering; the necessarily considerable hemorrhage that must occur, even if the larger vessels are uninjured; the deep situation of the bone, and its heavy muscular and fascial investments, much hindering the outflow of fluids; the abundance of lymph-vessels in the thigh; and the size and importance of the neighboring arteries, veins, nerves, and joints, one or more of which are so often associated in the lesion.

Tibial fractures, though less likely to terminate fatally than those of the femur, are yet very serious accidents, especially if of any considerable extent, and particularly if accompanied by fracture of the *fibula*. When the injury is a crushing one, and near the knee, rather profuse and troublesome hemorrhage is almost certain to ensue, even if none of the large vessels in the vicinity have been wounded. Great fissuring, longitudinal and spiral, is of frequent occurrence in this locality, and the fissures, though there may be so little separation of the fragments that prolonged walking is not at first prevented, may yet ultimately give rise to a fatal osteo-myelitis. Similar splitting of the fibula is much less often seen, the shot usually producing comminution or loss of substance ("exsection-fracture").

When the skeleton of the *foot* is injured, there may be great crushing, as from the blow of a piece of shell, or of a nearly spent large shot, or from the passage of a bullet, longitudinally or transversely, or the damage may be limited to one or two of the tarsal or metatarsal bones.

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[1] Larrey reports a case in which a ball, buried in the lower extremity of the tibia for nearly thirty years, caused an osteitis that necessitated amputation.

[2] Of over 2000 cases of fracture of the femoral shaft occurring in recent wars, more than three-fifths ended fatally (2142 cases with 1289 deaths, or 60.17 per cent.). The mortality according to location was: in wounds of the upper third, 72 per cent.; in those of the middle third, 60 per cent.; and in those of the lower third, 53 per cent.

[3] At least once such a result has followed a break lower down, viz., in Legouest's case of a young negro, wounded in the middle third of the femur, and who, in two months and a half, was able to walk, and had no shortening of the limb.

TREATMENT.—As in injuries of the upper extremity, the primary question, as respects treatment, is whether or not an attempt to save the limb can be made with reasonable prospect of a successful result, or at least with as much probability of preserving life as if amputation were performed? This question must be answered in the negative in cases of cannon-shot smash, and in those, in civil life, in which a small-shot charge has produced extensive laceration of the soft parts, comminution of the bone, and division of the main vessels or nerves. In cases of bullet *flesh-wound*, any other than the expectant treatment can be, at first, necessitated only by division of the femoral or popliteal vessels; and though, under such circumstances, there would be great danger of subsequent gangrene, and though intermediary operations are much more fatal than primary, few surgeons would be willing to do otherwise than apply ligatures and wait. Even if the femoral artery and vein were both wounded high up, a condition "that might be considered as absolutely necessitating immediate amputation," the patient's condition would probably be so feeble, from loss of blood, as to forbid an operation as grave as either disarticulation at the hip or amputation in the upper third of the thigh.

When the *femur* has been broken, whether or not *amputation* must be practised will depend upon the character of the fracture, its extent, its complications, and the necessity or otherwise of an early transportation of the patient from the place at which he has been wounded. If the shattering has been great, and the fragments are widely separated, with much accompanying tearing of muscle, primary amputation should be adopted, especially if the injury is located below the middle of the shaft; since, otherwise, the chances of recovery are but few, and, even if the patient survives, the preserved member is likely to be of little functional value, while very often necrosis will follow and ultimately compel removal of the limb, or prolonged suppuration may give rise to fatal visceral lesion. Associated injury of the femoral or popliteal *artery* or *vein* has generally, and with good reason, been held to indicate immediate amputation; but this operation is not always absolutely necessary, since experience has shown that after ligation of the vessel, gangrene may not occur; that repair of the osseous lesion may not be interfered with; and that, as in the case reported by Jobert (de Lamballe), the wound may heal with even less than the usual inflammation. If both artery and vein together have been divided, immediate amputation should if possible be performed above the level of the bone injury.

If the bone is only fissured, and this is likely to be the case in very many of the pistol-ball wounds of civil life, and in a considerable proportion of the injuries caused by the modern, elongated, conoidal bullet, the treatment should be by *expectancy;* the untorn periosteum serves to hold the fragments well in position, so that repair may take place rather quickly, if the development of osteo-myelitis can be prevented. Even in cases of comminution of moderate extent, by the early removal of detached splinters; by thorough drainage, with or without counter openings, according to the circumstances of the individual case; by immobilization of the whole extremity with plaster-of-Paris or wire splints;[1] by methodical compression over thick layers

[1] Decided advantage, as respects both the comfort of the patient and the ease with which the necessary dressings can be applied, will often result from *suspending* the immobilized limb. If immobilization is not made, as it always should be in one way or another, the treatment by suspension is very much better than any other, and some such apparatus as Smith's " anterior" splint or, preferably, Hodgen's splint should be employed. In leg-fractures, also, suspension is of much value. If any extending force or weight is put on in cases of comminution, it should be but a light one, simply steadying the parts.

of cotton; and by the adoption of all practicable measures, therapeutic and hygienic, to prevent the development of septic wound-complications, it is highly probable that, in the future, limbs and lives will be saved in much larger proportion than they have been in the past, and that this part of military surgery may prove much less unsatisfactory than heretofore.

As the result of Robuchon's investigations, it would appear that " 4234 amputations of the thigh, done at Antwerp, at Paris (1830), in the Crimea, in Italy, in America, and in Germany (during the war of 1870), had a mortality of 77 per cent." Of Beck's 171 cases in the Baden army, during the Franco-German war, 103 died, or 60.23 per cent., the primary operations resulting fatally in 50.62 per cent. (41 out of 81), the intermediary in 84.73 per cent. (16 out of 19), and the secondary in 64.8 per cent. (46 out of 71). Of Janes's 155 cases treated in the Letterman general hospital on the battle-field of Gettysburg, 54, or 34.84 per cent., died; 74, or 47.74 per cent., were discharged, cured; and 27, or 17.42 per cent., when last heard from, were living, but not cured. Of 1597 cases reported in Circular No. 6, S. G. O., 1029 died, or 64.4 per cent.; the mortality according to location, as far as yet determined and reported, was: in the upper third, 75 per cent.; in the middle third, 54.83 per cent.; and in the lower third, 46.09 per cent.

Though the published statistics of the most important wars of the last thirty years are, unfortunately, as yet incomplete, it would seem that there had been, since the commencement of the Crimean war, a decided increase in the percentage of recoveries with preservation of limbs. Such reports as that from the field of Langensalza (38 cases with 28 recoveries, or 73.6 per cent.); as that from Stromeyer's field-hospital at Floing (34 cases with 24 probable recoveries, or 70.6 per cent.); and as that of Beck (131 cases of fracture of the femoral shaft with 87 recoveries, or 66.5 per cent.), certainly indicate that in military practice, *when the wounded can be duly watched and properly treated from the time of injury, and need not be transported*, conservatism will give decidedly better results than amputation. With very much greater probability of a satisfactory recovery, expectancy may be resorted to in fractures of the thigh occurring in civil life, and its adoption should, under these circumstances, be the general rule.

Formal *excisions* in continuity should not be employed, on account of the very great danger to life,[1] and the probable uselessness of the limb if death should not occur. A dangling arm may yet be a useful one; a dangling leg is almost always simply an incumbrance, whatever sustaining apparatus may be applied.

In fractures of the *leg* not involving the knee- or ankle-joint—these have already been considered—expectancy yields, in general, better results than operative interference. *Amputation*—which is, of course, to be performed when there has been a complete crushing of the foot or leg, and which may very properly be resorted to, but is not imperatively demanded, when there is associated injury of the tibial vessels, or when both bones have been extensively comminuted—has been followed, in military surgery, by a very considerable and, at times, an excessive mortality. The death-rate of 8117 leg amputations (4413 tabulated by Robuchon, of which 1981 were fatal, and 3704 reported by Chenu from the French armies during 1870–1, of which 3050 were fatal) was 61.98 per cent.—a rate increased nearly one-half by the frightful mortality of the French operations during the war of 1870–1, 82.34 per cent., or more than 10 per cent. in excess of that among the French in the Crimea.

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[1] Of 47 cases tabulated by S. W. Gross, 41, or 87.23 per cent., ended fatally.

How greatly the death-rate of leg amputation varies at different times and among different troops, is shown by the following table from Chauvel : Siege of Antwerp, 22.7 per cent. ; Paris (1830–1832), 62.5 per cent. ; Denmark (1848–1850), 39.13 per cent. ; Crimea (English), 34.52 per cent. ; Crimea (French), 71.95 per cent. ; Italy (Austrians), 74.29 per cent. ; Italy (French), 66.57 per cent. ; U. S. Army (1861–5), 26.02 per cent. ; French (1870–1), 82.34 per cent. ; Baden troops (1870–1), 35.4 per cent. ; Hanoverians (1870–1), 36.5 per cent.

Primary *excision*, though it may be here performed with far better prospect of recovery than in the thigh, is not to be recommended, since, in the great majority of the successful cases, an equally good if not better result might, in all probability, have been secured with less risk by the simple removal of detached splinters. At a later period, for necrosis, resection of either tibia or fibula may very properly be employed in preference to amputation, and even after removal of a considerable part of the shaft—seven inches in one of Chipault's cases—much regeneration of bone may take place, and the patient may ultimately be able to walk very well with a little mechanical support.

Almost always in civil life, and generally in the uncomplicated bullet-fractures met with in time of war, the treatment should be by *expectancy*, the death-rate of which is from one-third to one-half that of amputation, according as the statistics of that operation are taken including or excluding recent French cases. Associated vascular or nervous lesions do not absolutely contra-indicate an attempt to save a limb, nor, as we have already seen, does even an accompanying wound of the knee or ankle. Traumatic aneurism, if it is developed, may be treated by ligation at the place of injury, or at a distance, on the proximal side—a method that answers decidedly better here than elsewhere. Venous hemorrhage, either primary or secondary, can generally be controlled by compression. The same treatment will often prove successful in cases of bleeding from the veins of the thigh, though the application of a ligature is surer and safer.[1] If, during the course of expectant treatment, the condition of the part or the general state of the patient renders it necessary, the limb can be removed, though with a greater probability of a fatal result than if the operation had been primarily resorted to.[2] Even at a much later period, amputation may have to be performed, on account of deformity, pain, or simple uselessness of the limb ; and the greater or less likelihood of the part having little or no functional value, if saved, must be taken into consideration in determining at the time of injury whether or not an attempt at preservation shall be made. The existence, therefore, of severe nerve-injuries, which are so apt to be followed by neuralgias, by trophic changes, and by secondary deformities from muscular contractures, will much influence the surgeon in deciding upon a primary amputation.

While, however, it may be said, in a general way, that bullet-wounds of the thigh or leg should be treated expectantly rather than by operation, and while statistics support this statement, it must always be borne in mind that the value of numbers is apparent rather than real. The particular circumstances of the individual cases, and of the special military operations in which the wounds have been received, must determine the course of treatment to be adopted, and not the simple fact that in so many thousand cases, collected

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[1] In a case reported by Desprès, of ligation of the femoral vein near the apex of Scarpa's triangle for secondary hemorrhage, "neither œdema nor pain followed, the ligature separated in six days, and the man rapidly recovered."

[2] Of Beck's 124 leg amputations, the mortality rate of the 66 primary operations was 33.33 per cent., of the 6 intermediary operations 66.67 per cent., and of the 52 secondary operations 40.38 per cent.

from numerous wars in different years and various countries, expectancy has yielded a higher percentage of recoveries than amputation.

Gunshot wounds of the *foot*, not involving the ankle-joint, are frequently met with in military practice, and occasionally—almost always as the result of accident—in civil life; and in a relatively large proportion of cases, fracture of one or more bones is present.

The *prognosis* of these injuries as respects life is not grave, though death may result from hemorrhage, from tetanus, or, much more generally, from septic complications. As respects, however, the after-usefulness of the limb, the gravity of these cases is quite considerable, for even if amputation, complete or partial, is not necessitated, muscular atrophy, tendinous adhesions and contractions, osseous deformities, or tender cicatrices, one or more, are very liable to seriously interfere with locomotion.

As a general rule, the *treatment* should be by expectancy, primary *amputation* being performed only when a part or the whole of the foot has been very extensively damaged. In toe-injuries, if amputation becomes necessary, it should be complete—at the metatarso-phalangeal articulation—except in the case of the great toe, of which any uninjured portion should be saved. In operating through the metatarsus or tarsus, no more should be removed than is absolutely necessary, and the skeleton of the foot may, with reference to amputations, be regarded as constituted of but a single bone. Amputations in contiguity are to be practised only when those further distant from the trunk, and in continuity, cannot be substituted; Chopart's operation is very likely, because of retraction of the tendo Achillis, to be followed by an unsatisfactory result as far as the comfortable use of the stump is concerned. The death-rate of amputations in front of the ankle-joint is not great, and that of amputations at the joint itself was, during our late war, but 13 per cent.—9 out of 69 cases.

Of 790 cases of toe-amputation, tabulated in Circular No. 6, S. G. O., only 6 or 0.76 per cent. terminated fatally; and of 119 partial amputations of the foot, only 11 or 9.24 per cent. Legouest's statistics, here as elsewhere, give a much higher mortality percentage, viz., 18.9 for the toe-amputations, 38.0 for partial removals of the foot, and 23.2 for disarticulations of the ankle. During the Crimean war, more than one-half (51.35 per cent.) of the cases of ankle-joint amputation among the French ended in death, while the proportion among the English was only about one-sixth (15.38 per cent.).

Expectant treatment in these cases must be conducted on the same general principles as in wounds of other regions. Lodged missiles, if of large size, should always if possible be found and removed, since their presence is almost certain to develop and maintain bone-inflammation.[1] When the injury, however, has been caused by a small pistol bullet, if the location of the shot cannot be determined by the use of the probe, no extensive incisions should be made in the hope of finding the ball. The ends of divided nerves and tendons, especially those upon the dorsum of the foot, may very properly be united with sutures. Hemorrhage, whether primary or secondary, if from any of the larger arteries, should be arrested by ligation, at the seat of injury, and not at a distance. Bleeding of a severe character is of frequent occurrence in these cases, and, if not properly treated, is very apt to produce most serious results. The dissection that may be required in order to find the wounded vessel will be much facilitated by the preliminary application

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[1] Stromeyer declares that "injuries of the tarsus generally are not very dangerous, and heal with unexpected facility, and without perceptible exfoliation, after extraction of the bullet."

of the Esmarch bandage. Free drainage must be secured, and suppurative teno-synovitis—which is quite likely to occur, as it is also when amputation has been performed—must if possible be prevented. The foot should be immobilized in a proper position, and much attention should be directed to the prevention of cicatricial deformities. If tetanus should be developed, and it is relatively frequent in these cases, early neurectomy might prove of great benefit. Carious bone should be gouged out, or the affected bone or bones removed. Even the entire os calcis has in a number of cases been taken away, and recovery with a useful foot followed; and judging from the results of extensive, and even complete, excisions of the tarsus for caries consequent upon other causes, similar operations might very properly be substituted for amputation in cases of bone disease following gunshot injury.

THE EFFECTS OF HEAT.

BY

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BURNS AND SCALDS.

NOTWITHSTANDING the progressive and protective character of modern civilization, with its manifold advances in the domestic arts and in applied science, and with all its humane provisions designed to avert accidental injuries, there seems to be no decrease, but rather an increase, in the number of casualties constantly occurring, and to which poor humanity is daily exposed. Among the most common of these casualties must be considered BURNS and SCALDS.

The immense increase in the use of steam machinery, fresh applications of which are so frequently announced, and the almost daily introduction of new agents of a combustible and explosive character, constitute fruitful sources of the increase in the number of those terrible injuries produced by excessive heat, which, even when not at once followed by death, frequently entail protracted suffering, and cause more or less distressing if not incurable deformity. Among the more prolific sources of this form of injury may be particularly mentioned accidents occurring in the manufacture and employment of coal-gas and gasoline, now so commonly used for illumination, cooking, heating, and other purposes; in the handling and refining of the various products made from petroleum, which have been extensively introduced all over the world; in the almost universal employment of steam, friction matches, and gunpowder; in the manufacture of chemicals, soaps, and candles; in the handling of hot fluids; and in conflagrations in breweries, refineries, factories, and galvanizing works; in theatres, and hotels; upon railroads; in mining and blasting—in fact wherever fire, steam, or combustibles of any sort are used. The record of our daily papers, and our hospital registers, amply attest the constantly increasing number of cases of accidental injury.

CAUSES OF BURNS AND SCALDS.

Burns from the direct contact of fire are very often seen among women, who, from their occupation and mode of dress, are liable to have their clothing ignite while cooking, as well as from treading upon matches, and from explosions incident to the very common practice of filling coal oil lamps while lighted, and attempting to kindle or quicken fires by pouring coal oil on slumbering embers. Unfortunately, those oils which are the cheapest, and consequently more generally used by the poor (who are also the more careless and improvi-

dent), are those which contain the most inflammable materials; only the heavy high-test oils (flashing at 160° F. and over) which are non-explosive, under ordinary circumstances, should, it is scarcely necessary to say, ever be used for illumination and household purposes. Men who have charge of steam machinery, furnaces, and rolling-mills, or who are employed wherever fires and steam are used, are constantly exposed not only to burns but to scalds. The latter injuries, when at all extensive, are often more serious than burns, not merely from the extent of surface involved, but because they are often complicated by the inhalation of hot steam, which, coming in contact with the fauces and trachea, induces, not infrequently, the most serious results. Children are often burned by drinking, or being splashed by, hot fluids, and occasionally they fall into tubs of hot water, as men do into vats of various hot liquids in breweries, and soap and chemical works. Every general hospital has doubtless experienced, as the result of an accident, a sudden influx of a large number of seriously burned or scalded patients. Ballet dancers, and those who wear light, gauzy, and very inflammable dresses, occasionally have their clothing take fire, and in their excitement communicate the flames to those about them. At the Continental Theatre, in Philadelphia, in September, 1861, ten female ballet dancers were so severely burned in this way that, after their admission into the Pennsylvania Hospital, six of them died without any effort at reaction. In these cases, from the extremely light texture of the dress, the body is at once enveloped in flame, and fatal results are almost inevitable—not only from the *depth* of the burns, but from the great extent of *surface* involved, as well as from the inhalation of destructive gases and of the heated products of combustion, all of which tend to bring about a fatal issue.

In years gone by, though not long past, our great lakes and western rivers were not rarely the scenes of frightful steam-boiler explosions, attended with immense loss of life; but these accidents, owing to better construction and more careful inspection of boilers, have within the last few years become very unusual. Burns and scalds occasionally occur on railways, the former being more common during the winter months, when the cars are heated by stoves. Scalds likewise result from boiler explosions incident to collisions, and are generally associated with great loss of life.

Curiously enough, upon the great central trunk line of Pennsylvania, upon which casualties are very rare, there occurred, during the summer of 1880, two accidents, almost identical in character; one was at May's Landing, New Jersey, near the eastern terminus of the road; the other at Pittsburgh, the western end of the line. In both instances, as a crowded excursion train was advancing in two sections, one a few minutes in advance of the other, the locomotive of the second section overtook the first, and penetrated its rear car, "telescoping" it. The branch steam-pipe was broken by coming in contact with the platform, and the steam escaped into and filled the car which was crowded with passengers, scalding them frightfully, while they were unable to extricate themselves. At May's Landing, New Jersey, out of some fifty or more who were seriously scalded, more than half died; and at Pittsburgh, of sixty-five persons who were injured in like manner, thirty perished.

Of calamities incident to burning buildings, factories, theatres, and tenement houses, no catastrophe has ever occurred in this country more fatal than the burning of the Brooklyn Theatre on the night of December 6, 1876, when more than three hundred persons perished in the flames. Another, and probably the most notable example in recent times, of loss of life from a similar cause, was the burning, in December, 1863, of some sixteen hundred persons, principally women and children, in the church at Santiago, in Chili, which took fire from the fall of some blazing altar-decorations.

A boiler explosion on board the ship "Thunderer," in 1876, injured some

eighty seamen, forty-five of whom died from the effects of the steam and hot water.

In March, 1862, a cartridge factory caught fire and exploded in Philadelphia, killing a large number of employés, and in many others causing most terrible burns; twenty-eight of the injured were brought to the Pennsylvania Hospital, and of this number nine died, seventeen were maimed for life, and only two were cured entirely of their wounds. And during the present year, two other instances of terrible loss of life are reported, one at Nice, where, with the total destruction of the theatre by fire, some seventy persons perished, and the other at Vienna, where in the burning of the Ring Theatre more than three hundred lives were lost. Many, if indeed not most, of the fearful and constantly increasing number of accidents occurring in our coal and mining regions, are caused by the premature explosion of gunpowder, or from what is commonly called "firing a shot," in a forbidden part of the workings. The air is impregnated with coal-gas ("fire damp"), and the mixed gas and air come in contact with a spark or flame. As one part of this gas with fifteen or twenty of air makes a most dangerous, explosive mixture, it is no wonder that serious accidents with terrible burns are so often observed. The lives of the large number of miners yearly lost by such accidents could, by a little care, be fully protected; but, as is usually the case, the accidents arise from a reckless violation of rules. The common history of these terrible casualties is that some fool-hardy miner has opened his "Davy lamp" to light his pipe, or to see better at his work, and, as a result, the lives of many are sacrificed, and the mine itself perhaps catches fire to burn for months or years.

Prophylaxis of Burns.

It is within a few years only that public sentiment has compelled the authorities in some parts of our country to take action in regard to the better security of life and limb in case of fire occurring in hotels, seminaries, colleges, hospitals, factories, and workshops of every kind, in which operatives are employed or in which many persons are congregated, and in which a truly criminal neglect of such precautions has almost universally existed. Especially are such precautions needed in tenement and school-houses. Now, in many of our large Eastern cities, the owner of any such building, more than two stories high, is compelled by law, under severe penalty, to provide for his employés permanent and safe external means of escape in case of fire. A fire-marshal, appointed for the purpose, is required to examine and test all such fire-escapes, and, if found satisfactory, to issue his certificate of approval.

In consequence of the constantly occurring accidents from fire in theatres and play houses generally, it has been suggested that the drapery of all kinds used in such buildings, and all stage paraphernalia, should be made uninflammable by the use of tungstate of sodium or fire-proof paint; a provision so important as to demand legislative action and general attention. In the same way the dresses of ballet girls, it is asserted, can be made fire-proof, without in the least changing the appearance of the fabric; and, as far as such dresses are concerned, this precaution at least should, by legal enactment, be made obligatory upon all proprietors of music halls and theatres.

The introduction of the parlor or safety match, instead of the common match, has unquestionably been the means of greatly diminishing the number of accidents by fire, and such safety fusees should alone be used in hospitals and public institutions. Thus, by ways too numerous to mention, it becomes necessary for those in authority to require the exercise of the greatest care,

in order to avert, as much as possible, the terrible danger from fire to which the sick and helpless especially may be exposed. The fact that, within the past ten years, fourteen hospitals for the insane in various parts of the country have been destroyed by fire, and in some instances with considerable loss of life, should be a sufficient warning to the various State legislatures to erect only fire-proof structures for the accommodation of the insane and the imbecile. If, in addition to this, the buildings were isolated, two-storied pavilions, connected, if so desired, by underground passages, similar to the new asylum at Norristown, Pa., with central arrangements for heating, cooking, and lighting, the chance of a destructive conflagration would practically be abolished; for, if a fire should accidentally occur, it could easily be controlled, and without danger to life or to the adjacent structures.

Fires involving considerable loss of life have occurred in the following State hospitals for the insane within a comparatively recent period :—

Augusta, Maine : a total destruction of the buildings ;
Brattleboro, Vermont : several patients lost their lives ;
Utica, N. Y. : centre building and portions of the wings destroyed ;
Columbus, Ohio : entire building swept away, and several patients lost ;
Lexington, Ky. : partial destruction of building ;
Hopkinsville, Ky. : entire loss of building ;
Williamsburg, Va. : loss of life uncertain :
Cleveland, Ohio : one employé died (a seamstress) ;
Mt. Pleasant, Iowa : building destroyed ;
St. Joseph, Mo. : greater part of building destroyed ;
St. Peters, Minn. : partial destruction of building, considerable loss of life (12 patients) ;
Danville, Pa. : almost entire destruction of hospital ;
Anna, Ill. : hospital partially burned, one patient lost ;
Ossowatomie, Kansas : fire early discovered, slight injury to building.

The last four fires occurred within six months of each other, and that at St. Joseph, Mo., within a year.

Effects of Burns and Scalds.

Burns are produced by the application of *fire* or *dry heat*, and scalds from *hot fluids* or *moist heat;* this, at least, is the distinction commonly made, but, clinically, these forms of injury are very much the same, and according to the intensity and duration of the applied heat and the capability which the solid or liquid possesses for retaining caloric, have we the varied grades produced. They may be variously caused by the sun's rays, or by the contact of flame, boiling water, oils, or other dense fluids, of heated or molten solids, or of concentrated acids or caustic alkalies, producing all the various forms of injury, from that of a simple erythematous blush or skin irritation, to that of torrefaction or carbonization of a limb or part, or of the entire body.

The varying effects are explainable by the peculiar methods of application of the destructive agent; thus, as remarked by Wilson, " in degree, heat may be feeble but prolonged, or it may be strong and instantaneous, strong and continued for a brief period, or strong and continued for a long period." The passing flame of burning *ether* or *alcohol* causes a superficial burn, while the contact of burning *sealing wax* or of boiling *oil*, the ability of which substances to retain caloric is greater than that of water, because of their greater density, gives rise to a much more pronounced injury. Molten *metal*, if simply striking the skin, causes vesication; but if, as in a recent case under the writer's care at the Pennsylvania Hospital, the molten iron gains access to and surrounds a limb—being poured into a puddler's boot—complete charring and destruction result.

A scald, even if severe, may leave the cutaneous hairs uninjured, and thus a scald from hot water may often be diagnosticated from a burn; yet in only moderately severe injuries can this test be made available, for the hair may be singed or destroyed by hot, *dense* liquids as well as by flame. Burns are usually more serious than scalds, and are apt to be followed by deep slough-ing; yet scalds, from the great extent of surface involved, are not uncom-monly fatal. Concentrated *acids* and caustic *alkalies* in solid or liquid form, act powerfully and energetically upon the soft tissues, and thus give rise to burns of the most serious character. Unfortunately, many of these accidents occur at a time when the manipulator is stooping over the chemicals, which, either by explosion or by splashing are brought in contact with the neck, face, eyes, and hands, these being the parts usually most exposed.

Phosphorus acts powerfully, causing rapid and deep inflammation of the tissues, and fatal results have attended its improper and careless handling.

A young man, while journeying on a railway, lit a parlor match by scratching it with his thumb nail. A piece of the incandescent phosphorus penetrated under the nail, and made a slight burn, to which, at the time, he paid little attention. After the lapse of an hour, the pain became intense, and the thumb, hand, and forearm, in rapid succes-sion, became greatly inflamed and enormously swollen. A few hours later, symptoms of gangrene were observed, and death ensued in twenty-seven hours after the reception of the burn.

The skin, when it has been extensively injured (as in women whose clothes have taken fire), often exhibits burns of all degrees and presents a curiously varied and mottled appearance. When the tissues are burned in the third degree, the eschars are hard and dry, vary in color from ashen-gray to black, and are insensitive to touch; if the skin is only partially destroyed, pressure is exquisitely painful. The line dividing the injured from the uninjured skin is often difficult to determine and is very irregular. The odor of the burned tissues is characteristic and unmistakable. It is not possible, immediately after the occurrence of the accident, to determine how far the subcutaneous tissue has been injured, for the surface appearances are nearly the same when the muscles or the deeper parts or even the bones have been involved.

Islands of uninjured skin often exist, contrasting strongly with the sur-rounding injured tissue, which is highly congested and presents a mottled red color, frequently traversed by an immense number of radiating vessels which are blocked by sudden coagulation of the blood. It is usual to find the upper part of the legs, the thighs, and the lower part of the abdomen and chest involved where the clothes have taken fire; the ankles, feet, hands, and forearms are often simply blistered, the latter being usually burned in the patient's attempts to get rid of the fire; the neck and face, on the other hand, are commonly severely burned, as they are enveloped by the ascending flames.

Surface burns from *lightning stroke* present about the same appearances as burns from other sources; the skin is reddened and blistered, and the hair is often singed or entirely destroyed. A peculiarity, not infrequently seen in burns from lightning, consists in the detached or separated character of the burns, caused most likely by the electric fluid being conducted from place to place by portions of steel, iron, or other metals which are so often found in the clothing, especially in the case of females.

Concentrated acids and caustic alkalies which destroy the dermic tissues, act, as already mentioned, powerfully and rapidly: they give rise to burns which, from the absence of vesication and of other symptoms found when there has been contact with fire, may readily be distinguished by their ap-pearance from burns produced by flame. In these cases inflammation is

soon established, and there is usually great swelling from the rapid development of cellulitis; the surface of the burn is early covered with a grayish unhealthy-looking lymph. When the skin of the face is involved, swelling occurs so rapidly that the eyes are soon completely closed, the face assumes an erysipelatous appearance, and the discharges, rapidly undergoing decomposition, give rise to fetid and depressing odors. Burns from *nitric acid* present yellowish stains or patches, while those from *sulphuric acid* and from caustics generally, give rise to reddish or reddish-brown discolorations. When the cutis has been destroyed, the devitalized tissues are separated by the usual sloughing process. This separation of dead tissue occupies a very variable time, and is influenced by the patient's general condition, and by the depth and extent of surface involved. After the sloughs have separated, exuberant granulations arise, and are often so abundant that cicatrization is rendered very difficult, and that, as a consequence, repair progresses slowly. In the healing of such surfaces, immense disfigurement and great distortion of parts sometimes result. Vicious cicatrices often follow, with anchylosis and forced flexion of joints.

These *scars* of burns, which are often frightfully disfiguring, were formerly believed to be endowed with a disposition to continued contraction, and this was thought to exist for a long time after the parts had permanently healed up; but there does not seem, in fact, to be any essential difference in this respect between the cicatrices from burns and those from other injuries. Hypertrophy of these scars not infrequently occurs, which resembles, and is occasionally mistaken for, *keloid*—a disease of the skin, occurring quite independently of injury. As a result of the formation of cicatrices, the jaw is at times anchylosed, and the chin drawn down upon the sternum; the mouth is everted, or kept permanently open; the teeth lose their vertical position; the eyeballs, by ectropium, are left uncovered; the head is immovably fixed and drawn to one side or the other; the fingers and toes are anchylosed, flexed, webbed, or twisted laterally quite out of shape; and the wrist, elbow, ankle, and knee-joints are often distorted and immovably held in awkward and useless positions. Cicatrices from burns may usually be distinguished from cicatrices from other injuries by their size and appearance; they are usually densely white, elevated in folds or ridges, and frequently puckered, the new tissue being delicate and sometimes very vascular and pinkish in appearance. Cicatricial tissue, if subjected to pressure or stretching, is disposed to ulcerate, and when the destruction of skin from a burn has been very great, it is occasionally impossible to heal the ulcerated part by cicatrization, even though aided by skin-grafting or transplantation of integument. Amputation of a limb under such circumstances may be required to save life.

I recall a case of a lad thirteen years of age, who came under my care some years ago, and who had lost from a coal-oil burn every vestige of skin from the fingers to the shoulder, the entire surface presenting one huge granulating ulcer. To save life, which was threatened from the immense drain, the limb was removed at the shoulder-joint.

In some cases, portions of hands or feet, now and then the side of the head, and occasionally the external ear, are seriously compromised or destroyed. A large portion of the integument either of the extremities or of the trunk may be involved.

These injuries now and then occur in *epileptics*, who, at the time of the accident, are quite unconscious of injury.

Recently I had under my care a boy who, in an epileptic seizure, fell upon a hot stove, causing a most severe burn of the third degree involving the principal part of the skin, subcutaneous tissue, and superficial muscles of the thigh. Many similar cases involving the extremities have come under my observation.

COMPLICATIONS AND CAUSES OF DEATH AFTER BURNS.

Burns may prove early fatal from *shock ;* from the exhaustion incident to the intense strain upon the nervous system, that is, from paralysis of the nerve-centres from *congestion of internal organs ;* from *pulmonary* and *gastro-intestinal inflammations* or *ulcerations ;* and, at a later period, from *exhaustion* incident to drain from various sources, and also from *pyæmia, septicæmia, erysipelas,* or *tetanus ;* the advent of blood-poisoning is announced by rigors, and the usual symptoms of metastatic abscesses. Professor Ponfick, in endeavoring to determine the cause of sudden deaths after burns, hitherto unexplained, found in animals, at once after severe burns, a profound alteration and destruction of the red blood corpuscles, and concluded that as a consequence the internal organs, and particularly the kidneys, suffered correspondingly from *infarcts* owing to capillary embolism by masses of altered hæmoglobuline ; and he accordingly has ascribed the sudden deaths which so commonly occur in burns and scalds to the excessive destruction of the blood corpuscles. To supply the red corpuscles thus lost, transfusion of blood has been suggested as the most appropriate treatment. The congestion of the lungs and subsequent pneumonia often observed may have some connection with this blood change.

Scalds of the mouth, pharynx, and glottis now and then happen to young children, who by mistake drink boiling water from the spouts of tea-kettles: grave symptoms soon ensue, chiefly caused by inflammatory swelling and *œdema of the glottis;* occasionally *diphtheritic deposit* takes place, and suffocation becomes imminent, requiring tracheotomy. This operation, however, is in these unfortunate cases usually unsuccessful. Of twenty-eight cases in which the operation has been performed on account of scalds in the larynx, twenty-three have terminated fatally.

Occasionally burns of the face and head are followed by erysipelas ; and, when the eyeball is involved, *keratitis,* ulceration, and sometimes *corneal perforation,* with destructive inflammation of the globe, ensue.

SUNBURNS.

Although these injuries are usually very trivial, so slight generally as to require hardly a passing notice, yet occasionally persons who have a delicate skin suffer severely from brief exposure, not only to intense but even to ordinary sunshine. This form of burn is characterized by a diffuse redness of the skin, with more or less persistent smarting pain. It usually occurs in the summer season, and affects more often those who are unused to exposure to the sun's influence. The face, neck, forearms, and hands are usually involved. Serious symptoms now and then arise, when a very large extent (two-thirds) of the surface is implicated, and even fatal results from sunburn—from violent inflammation of the skin, with gangrene—have been reported. Upon the subsidence of the erythematous redness, desquamation of the epidermis takes place, the color changes to a reddish-brown, and the skin gradually but slowly regains its normal state. Dr. Morris Longstreth, one of my colleagues at the Pennsylvania Hospital, who has had an unusual experience in this form of burns, writes me as follows :—

"The cases of sunburn that I have seen included examples of almost every grade of the affection, varying from a slight redness of the hands and face, of no moment, except from an æsthetic point of view, to a burn that involved more than half of the

whole cutaneous surface, and brought in peril the life of the patient.   Let me particularize some of the striking or curious features : I have seen a number of cases where only the forehead and eyes were involved.   In these instances, the patients, while boating, having shade hats, and having the lower parts of their faces muffled in veils, were well protected from the direct rays of the sun, and were only exposed for a short time to the reflection of the sun's rays from the smooth water.   The result was that after a period of about twenty-four hours or less, varying with the delicacy of the skin, the exposed portion of the face became red, with pain and a burning sensation, which symptoms were soon followed by swelling of the exposed part.   In one case, the hair being arranged in crimps, the skin protected by the wavy ringlets escaped, and the forehead presented a most fantastic appearance from the intermingling of the red and swollen with the normal skin.   In some of these cases the eyelids escaped, apparently from the lids being raised and constantly folded back, and therefore not exposed.   In two cases the lids were so swollen that, at the end of forty-eight hours after exposure, it was almost impossible for the patients to uncover the pupillary opening, or to see any objects excepting those in front and below.   In one instance the ocular conjunctiva became greatly swollen, with a few small spots of ecchymosis; in this case I had no reason to believe that either a foreign body or the wind caused the conjunctivitis, and the affection seemed to be due wholly to the sun's rays, as other parts of the face had suffered from the same cause.

" These were certainly not cases of erysipelas, and the symptoms indicated no febrile or constitutional disturbance.   Another very striking case of sunburn was from exposure of the forearms while rowing.   The striking features of this case were the apparent involvement of the muscles, or the intermuscular septa of connective tissue, and of the tendons, or their bursæ, at the annular ligament of the wrist.   The patient came to me on account of the severity of the sunburn of the skin, which was so painful as to prevent sleep, and I had the opportunity to observe the development of the symptoms in connection with the muscular tissue.   The skin of the dorsal surface of the forearms was completely blistered from the elbow to the knuckles ; the vesicles, or rather one large vesicle, as I may almost call it, were filled abundantly with clear serum, which afterward became cloudy and opaque, and at some parts purulent.   At first the pain was of a burning character, and confined to the surface ; after about forty-eight hours pain was felt in the deeper parts also, and very considerable stiffness of the arm and fingers came on.   At the wrist and on the dorsum of the hand—parts at which the cutaneous surface was less sunburned than on the forearm proper—the pain and stiffness on attempted motion was felt in the exact line of the tendons, and the swelling of the deeper parts came on simultaneously with the advent of these symptoms ; an increase of swelling in the forearm likewise occurred, and the swollen skin, itself previously swollen, but loose, now became tense.   This case lasted more than a week, and freedom of motion returned slowly.   The wrist-joints were not affected, but small furuncles or glandular obstructions occurred.

" In the last and most curious case which I shall speak of, for some hours it was questionable whether the patient would survive, owing to the great extent of the surface sunburned, and the hourly expectation that all the involved skin would become vesicated.   The patient, a young man of seventeen or eighteen, spent the day on the water in a rowboat.   His companion, accustomed to rowing—stripped to the waist, as is the custom at Cambridge—had a well-tanned back, and did not suffer from the effects of the sun.   My patient, emulous of his friend's good, healthy, brown color, sat in the sun without any covering during many hours.   The day was not a hot one, the thermometer certainly not rising above 70° F. in the shade.   That night the skin was painful, and sleep was much disturbed.   The next night I saw the patient sitting up in bed naked to the waist, as the contact of clothing could not be endured, and a draft of air from a window caused agony.   I did not comprehend the gravity of the situation until the following morning, when I found the more delicate parts of the skin beginning to blister, while the fiery redness of the remaining portions indicated the likelihood of the whole of the face, neck, arms, and trunk, both front, back, and side, doing likewise.   Fortunately, vesication ceased, and anxiety was relieved—anxiety rendered unendurable because his friends could not be made to understand the gravity of the case."

Prognosis of Burns and Scalds.

On account of the greater delicacy and susceptibility of the skin to the action of heat at certain periods of life, and in some persons more than in others, the prognosis of burns and scalds may be rendered serious. For these reasons, in the case of children and infants, severe and fatal scalds have been produced by their being placed in baths supposed to have been properly tempered; and not uncommonly, in the confusion incident to the occurrence of a convulsion, a hot foot bath has cost the patient serious loss of integument. Some years ago, I witnessed the entire destruction of a portion of a palsied foot, by the injudicious use of a hot brick, applied for the purpose of inducing a better circulation. Another point which it is important to bear in mind, in considering the effects of heat, is, that according to the bodily condition of the patient at the time of the reception of a burn or scald, it may terminate favorably or the reverse. Not long since, a young man in one of our insane asylums in Philadelphia drew from a spigot a bucket of scalding water, placed both his hands in it, and held them immersed some minutes before he was discovered; his bodily condition was enfeebled at the time, and he shortly afterwards died from cerebral inflammation. . As a result of comparatively slight burns and scalds, persons of weak or nervous temperament, reduced by intemperate habits, or who have renal or other visceral disease, may, with this additional shock, be fatally prostrated.

Cerebral hyperæmia, with delirium more or less marked, a result of vaso-motor paralysis, is occasionally seen after burns and scalds, and similar symptoms have been observed after exposure to the rays of the sun. Experiments made by Brown-Séquard would seem to show that through the intermedium of the spinal cord, the various remote effects of burns and scalds are produced by reflecting the irritation to the secondarily affected organs. The remote action of the burn, however, is not on the tissue of the organs themselves, but "on the vaso-motor nerves of the bloodvessels, which, in consequence of the morbid impression, are paralyzed. It seems distinctive of reflex vaso-motor paralysis that the hyperæmia is *diffuse*, while that of tissue irritation is more localized, and tends more to exudation and suppuration."[1]

Classification and Symptoms of Burns.

The classification of burns into six degrees, as originally suggested by Dupuytren, and since generally accepted by surgeons, is unnecessarily complicated; a division of these injuries into three groups will be found amply sufficient for all practical and clinical purposes, and will therefore be adopted here:—

Burns of the First Degree: Hyperæmia; erythema; irritation or inflammation of the skin without vesicles.

Burns of the Second Degree: Vesication; inflammation of the skin; formation of vesicles and bullæ.

Burns of the Third Degree: Eschars; gangrene, superficial or deep, involving the skin or any other subcutaneous tissues; carbonization of a part, or of the entire body.

BURNS OF THE FIRST DEGREE (Hyperæmia; Erythema).—There is more or less diffused redness of the skin, which disappears under the pressure of the finger, and occasionally swelling and pain of a burning or smarting character. These symptoms may continue for a few hours or days, when the epidermis soon separates by exfoliation, and the natural condition of the skin is restored. Generally no permanent injury follows.

[1] C. Handfield Jones, Clinical Observations on Functional Nervous Disorders.

Constitutional Symptoms.—Occasionally there is ephemeral or irritative fever, but there are ordinarily no marked constitutional symptoms. Yet from the greater susceptibility of some individuals, or from the large extent of surface involved in some cases, shock may be quite pronounced, in burns of this variety, and may even prove fatal. If two-thirds of the surface are involved, death is almost inevitable.

A man was brought to the Pennsylvania Hospital in a collapsed condition, with a feeble pulse and dyspnœa, the result of an explosion of illuminating gas. The skin was hardly reddened, yet death finally ensued from the immense extent of surface involved.

Irritation of the intestinal canal, and cerebral, pulmonary, and vesical complications are occasionally observed.

Burns of the Second Degree.—The redness, pain, and swelling which characterize burns of the first degree are present in cases of this variety, and from exposure to a higher temperature (167° F.), the hyperæmia tends to exudation, vesicles form, and serous effusion takes place from the engorged vessels of the inflamed, erythematous skin. These transudations are of all sizes; when considerable, they are called bullæ. Vesicles either form at once, or appear in the course of a few hours; sometimes the effusion occurs so rapidly that the vesicles burst, and the collapsed epidermis is seen lying in whitish folds on the inflamed and excoriated skin which is exquisitely sensitive.

The serum is usually transparent, but occasionally it reveals a trace of blood. In the course of a fortnight the epidermis may be entirely replaced.

Usually in the formation of the vesicles there occurs no permanent injury of the skin, but occasionally suppuration and ulceration follow.

Constitutional Symptoms.—These vary in accordance with the severity of the burn, and with the extent of the surface involved. Shock with immense prostration, in severe cases, is always present, and death results at once in some instances from simple neuro-paralysis; in others, there is associated congestion of all the internal viscera, and death from cerebral effusion with delirium. Following reaction, inflammation of the internal organs is not infrequent. With a rise in the temperature, albumen is commonly, if not uniformly, found in the urine, and at a later period, ulceration of some portion of the intestinal tract has been observed.

Burns of the Third Degree.—The third degree of burns embraces those attended by the formation of eschars, superficial or deep, involving a part or it may be the entire body. In this group are classed all those cases of acute gangrene resulting from injuries of this character, which affect a portion of skin, or of skin and subcutaneous tissue. A temperature of or near the boiling point of water is required to destroy the skin by the coagulation of its albumen. In burns of the third degree, according to .the duration and intensity of the applied heat, the skin alone, or the muscles, nerves, bloodvessels, and bones may be destroyed, even to carbonization. Destruction of the entire body can only happen when a person falls into a furnace or limekiln, or is imprisoned in a burning building. Although carbonization of a whole limb is not common, yet now and then, in drunken coma, etc., portions of limbs have been totally burned off.

Constitutional Symptoms.—If reaction takes place, the symptoms at once assume grave proportions, according to the extent of the injury. In some instances death soon ensues from coma; a result of congestion of the brain, with more or less serous effusion. In like manner the lungs, or the intesti-

nal mucous membrane and kidneys, may become congested or inflamed. The period of inflammation extends from the occurrence of reaction to the beginning of the period of exhaustion, during which time the dead or devitalized tissues are being thrown off by suppurative action. The exhaustion incident to suppuration is sometimes aggravated by venous or arterial hemorrhages. During this period the kidneys, the intestinal canal, and the nerve centres are liable to irritative or inflammatory changes. The renal changes indeed are constant. In all cases of burns and scalds of the second or third degrees, involving any considerable extent of surface, where marked constitutional disturbance exists, the kidneys become congested or inflamed, and albuminuria is produced. The early presence of albumen in the urine has long been recognized, but not so generally as might have been expected, for even quite recently systematic articles have appeared on the subject, supposed to cover the entire question, without a word bearing upon this important pathological change.

During the year 1880 a number of examinations were made for me at the Pennsylvania Hospital, with great care, by the resident physician, Dr. Henry M. Wetherill, in a large number of cases (including those already referred to), and especially in the cases of scalding from the May's Landing disaster; and, as a result, albumen was found in every instance, except in those of the most trivial character. Albumen was observed in some cases as a mere ring, with nitric acid, while in the fatal cases it often amounted to two-thirds of the bulk of the fluid. A careful daily examination of the temperature in all the cases was made, and it was found that, in all those burns or scalds of the first degree in which no variation from normal temperature occurred, no albumen was discovered; but that in injuries of the second or third degrees when a temperature of $101\frac{1}{2}°$ or $102°$ F. was reached, albumen was invariably present. With the graver and fatal cases, with a temperature of $104°$ or $105°$ F., or higher, the amount of albumen was correspondingly increased. In thirteen cases, in the hospital at one time, a daily examination was made of the temperature and urine: eleven showed albumen; in the two cases in which it was absent the injuries were trivial and very superficial. In one of these cases, the patient was in the hospital but four days, in the other, ten days, and in both the patients were quite well when discharged. Of the eleven cases which showed albumen, five were cases of extensive burn, four of which ended in death and only one in recovery; of the remaining number, six were cases of merely superficial burn, involving the face, neck, hands, and shoulders. All of these terminated in recovery but one, and in that case the fatal issue was caused by inflammation of the chest and air-passages, due to the inhalation of steam. In these eleven cases of burn with albuminous urine, the temperature was no higher than $99°$ F. on admission; in four instances, when the temperature reached $101°$ F., albumen was found; in each case, when the temperature reached $102°$ F., the amount of albumen was marked; and, as the temperature increased, so likewise the quantity of albumen increased, and the specific gravity lessened.

In one case of extensive general burns in a pregnant woman, nearly at full term, the temperature, upon admission, was $99°$ F., and the urine was albuminous (as frequently occurs in the condition of pregnancy); within forty-eight hours the temperature ran up to $105°$ F., while the specific gravity of the urine fell to 1006, being heavily charged with albumen, but without casts. Death occurred on the fourth day, the temperature being then $105.5°$ F. On the second day after the injury, the patient was delivered of a dead infant, the interesting fact being noted, that the child was, upon the surface of its body, apparently blistered and burned in extent and in places almost exactly corresponding to the injuries of the mother.[1]

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[1] Hunt, American Journal of the Medical Sciences, January, 1881, p. 186.

Date.	Pulse.	Respiration.	Temperature. 96°–105°		Condition of Urine.
May 29	80	20		M.	Urine normal. Sp. gr. 1021
	92	18		E.	
30	100	22		M.	
	120	30		E.	Trace of albumen. Sp. gr. 1020
31	88	24		M.	
	106	28		E.	Sp. gr. 1014
June 1	100	30		M.	
	122	28		E.	
2	100	24		M.	
	108	28		E.	Urine scanty and high-colored; distinctly albuminous; no casts, but desquamated epithelium.
3	118	30		M.	
	118	32		E.	Sp. gr. 1018
4	122	24		M.	
	120	31		E.	Sp. gr. 1016
5	90	20		M.	
	102	20		E.	Sp. gr. 1010
6	100	24		M.	
	94	23		E.	
7	96	20		M.	
	106	28		E.	
8	90	24		M.	
	88	20		E.	Urine normal.
9	86	20		M.	
	78	22		E.	
10	76	18		M.	
	96	22		E.	
11	88	20		M.	
	102	20		E.	Trace of albumen. Sp. gr. 1016
12	102	20		M.	
	90	20		E.	Trace of albumen. Sp. gr. 1018
13	86	20		M.	
	90	24		E.	
14	90	20		M.	Urine normal. Sp. gr. varying from 1018–1022
	88	20		E.	
15	80	20		M.	

96° 97 98 99 100 101 102 103 104 105°

Fig. 302.—Temperature chart of L. J. Extensive burns of face, neck, arms, forearms, hands, legs, and feet. Recovery.
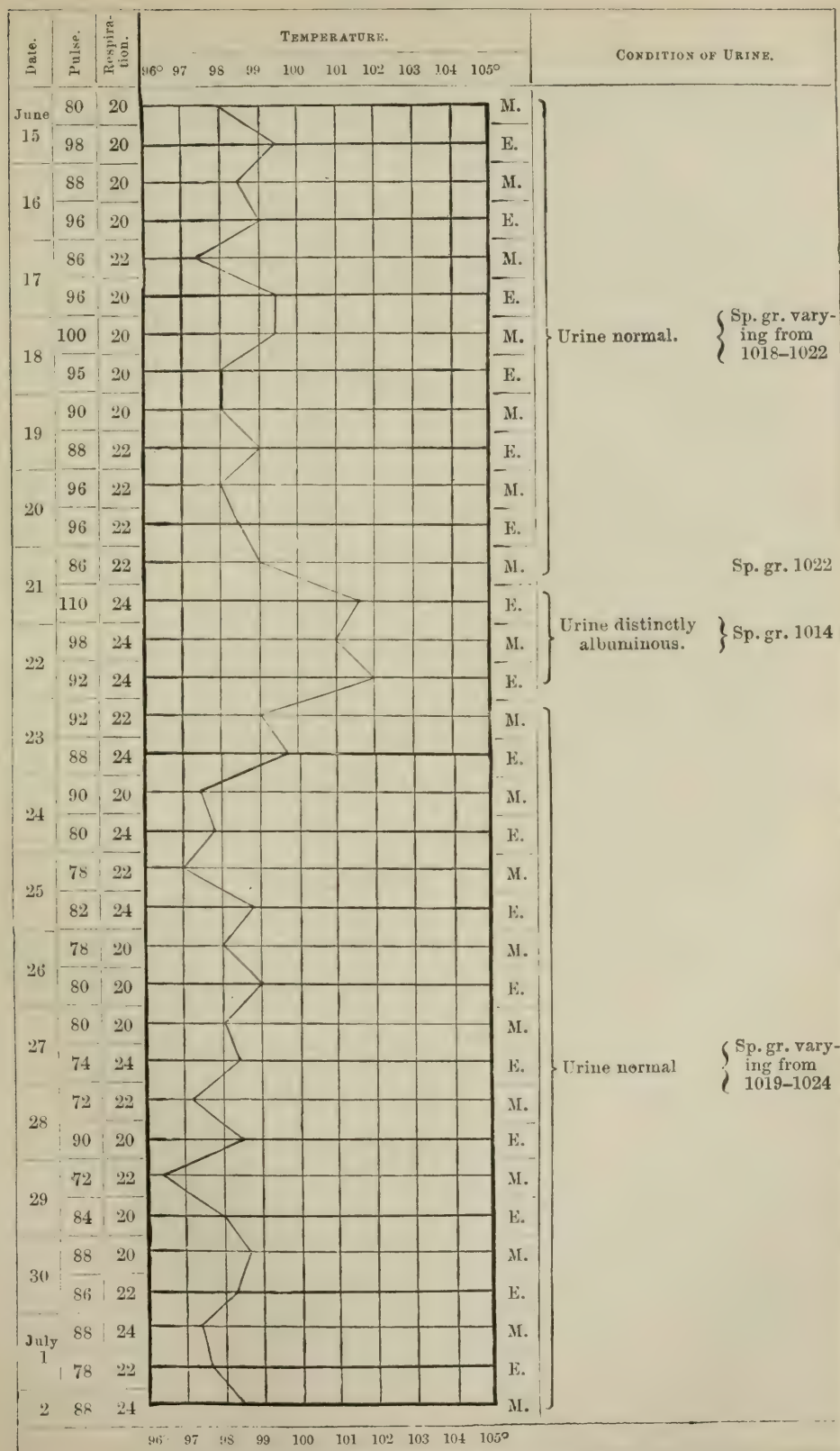
Fig. 303.—Temperature chart of L. J. *concluded.*

That albumen appears very soon after the reception of severe and even of almost immediately fatal burns, is shown by the following case :—

Early on the 28th of January, 1881, a woman, sixty years of age, suffering from extensive burns, was admitted into my ward at the Pennsylvania Hospital. The case was

Date.	Pulse.	Respiration.	Temperature.		Condition of Urine.
May 11	84	33	E.		
12	90	30	M.		Urine normal; no albumen. Sp. gr. 1022
12	110	40	E.		
13	128	38	M.		
13	124	40	E.		
14	118	40	M.		Sp. gr. 1021
14	110	35	E.		
15	110	24	M.		Urine contains albumen, at first in small amount, but steadily increasing day by day as temperature rises. Sp. gr. 1014
15	108	28	E.		
16	100	26	M.		
16	120	30	E.		Sp. gr. 1008
17	108	30	M.		
17	125	36	E.		Sp. gr. 1010
18	98	25	M.		Albumen forms $\frac{1}{8}$th bulk of urine; renal epithelium and epithelial casts. Sp. gr. 1010
18	108	28	E.		
19	100	24	M.		
19	100	30	E.		Sp. gr. 1016
20	95	23	M.		
20	112	30	E.		Urine loaded with albumen, epithelial casts, renal epithelium, and blood corpuscles. Sp. gr. 1016
21	105	32	M.		
21	120	36	E.		Sp. gr. 1014
22	90	32	M.		
22	120	40	E.		Sp. gr. 1010

Fig. 304.—Temperature chart of E. K., aged 37. Extensive burns of face, neck, arms, hands, and trunk, varying from first to third degree. Death.

Date.	Pulse.	Respiration.	TEMPERATURE.		CONDITION OF URINE.	
April 24	90	30		E.	Urine normal.	Sp. gr. 1020
25	85	26		M.		Sp. gr. 1018
	100	24		E.		
26	100	26		M.	Urine contains a small amount of albumen.	Sp. gr. 1018
	100	24		E.		
27	105	30		M.		
	105	30		E.		Sp. gr. 1018
28	88	30		M.		
	88	30		E.		Sp. gr. 1016
29	76	30		M.	Heavy ring of albumen.	
	84	30		E.		Sp. gr. 1014
30	80	26		M.		
	90	32		E.		Sp. gr. 1019
May 1	84	20		M.		
	90	20		E.		Sp. gr. 1016
2	88	20		M.	Trace of albumen.	
	95	32		E.		Sp. gr. 1016
3	88	26		M.		
	100	35		E.		Sp. gr. 1018
4	96	26		M.		
	100	36		E.		Sp. gr. 1010
5	92	26		M.		
	100	34		E.	Urine again quite albuminous; contains renal epithelium and epithelial casts, with a few hyaline casts and blood-corpuscles.	Sp. gr. 1012
6	98	28		M.		
	102	28		E.		Sp. gr. 1014
7	105	20		M.		
				E.		Sp. gr. 1010

Fig. 305.—Temperature chart of C. M., aged 47. Extensive superficial burns of face, neck, trunk, arm, hand, and thigh of right side. Death.

so severe, and so unquestionably going to prove fatal, that I directed that she should not be disturbed in order that the usual dressings might be applied, but that she should be simply covered with blankets and given morphia and stimulants. Her urine was drawn by the catheter, and proved, on examination, to be normal. The temperature at this time was 97° F. The following morning the urine was again drawn, and, upon examination, showed a considerable quantity of albumen. Death occurred soon afterwards.

The accompanying temperature charts have been selected from those of the eleven cases which showed albumen. It is interesting to note in several, that, when the temperature rose to 101° F. or 102° F., albumen appeared in the urine, and that as the albumen increased in amount the specific gravity became less, while as the albumen diminished the specific gravity increased, becoming finally normal as the last trace disappeared. In the chart represented by Figs. 302 and 303, this is well shown, as also that the patient had several exacerbations of fever while under treatment, during which periods alone was albumen present—the specific gravity keeping pace with its presence or absence. In the charts copied in Figs. 304 and 305, it will be seen that, as the cases approached a fatal termination, renal epithelium, casts, and blood corpuscles appeared in the urine. None of these cases presented, upon admission, any evidences of renal disease. Fig. 306 represents the chart obtained from an interesting case, already referred to, of general burns from the first to the third degree; the patient was pregnant, and was delivered of a still-born child four days after admission. The urine, although albuminous on admission, was not more so than is often found during pregnancy, but within forty-eight hours it was loaded with albumen, and at the same time the temperature rose to 105° F., and the specific gravity of the urine, which on admission had been 1014, fell with the rise in temperature to 1006 and 1008. Figs. 307 and 308 also show the rapid rise in temperature and the association of albuminuria, the urine having lost, during the course of treatment, all trace of the albumen it had previously contained. As the temper-

Date.	Pulse.	Respiration.	TEMPERATURE.									CONDITION OF URINE.	
			99°	100	101	102	103	104	105	106°			
May 12	80	20									E.	Urine distinctly albuminous upon admission, a condition due to patient's pregnancy.	
13	116	20									M.		Sp. gr. 1014
	98	18									E.		Sp. gr. 1016
14	105	24									M.		Sp. gr. 1010
	160	30									E.	Urine very heavily charged with albumen, but no casts.	Sp. gr. 1006
15	150	30									M.	Urine drawn by catheter and therefore not mixed with lochial discharge.	Sp. gr. 1014
	160	30									E.		Sp. gr. 1008
16	160	28									M.		Sp. gr. 1010
			99°	100	101	102	103	104	105	106°			

Fig. 306.—Temperature chart of A. L., aged 30. Extensive general burns, varying from burn of first degree to one deeply involving muscles. Patient was eight and a half months advanced in third pregnancy. On the evening of May 13, she was delivered of a still-born female child, the fœtal heart-sounds of which had been plainly audible until within four hours of birth. The child was marked all over its surface with burns and blisters, the locality of which strangely corresponded with similar burns and blisters upon the parent. Death.

Date.	Pulse.	Respiration.	TEMPERATURE.		CONDITION OF URINE.	
			97° 98 99 100 101 102 103°			
June 6	80	20		E.	Urine normal.	Sp. gr. 1021
7	92	20		M.		
	84	20		E.		
8	86	18		M.		
	90	18		E.		Sp. gr. 1018
9	94	20		M.		
	96	22		E.	Tested with nitric acid, urine shows a heavy ring of albumen.	Sp. gr. 1012
10	94	21		M.		
	98	20		E.		Sp. gr. 1016
11	100	20		M.		
	94	18		E.		Sp. gr. 1016
12	96	18		M.		
	89	18		E.		Sp. gr. 1016
13	88	18		M.	Trace of albumen.	
	86	20		E.		Sp. gr. 1018
14	84	18		M.		
	84	20		E.		Sp. gr. 1014
15	80	18		M.		
	86	18		E.		
16	80	18		M.		
	84	20		E.		
17	84	20		M.		
	84	22		E.	Urine normal.	Sp. gr. varying from 1018–1024
18	80	20		M.		
	84	20		E.		
19	80	18		M.		
	80	20		E.		

97° 98 99 100 101 102 103°

Fig. 307.—Temperature chart of T. M., aged 35. Scald of entire hand and fingers by steam; scald of 1st, 2d, and 3d degrees. Recovery.

Date.	Pulse.	Respiration.	Temperature. 97° 98 99 100 101 102°		Condition of Urine.
June 20	88	18		M.	Urine normal. Sp. gr. 1022
	80	21		E.	
21	86	22		M.	
	84	22		E.	Urine normal. Sp. gr. 1024
22	72	22		M.	
	76	20		E.	
23	66	18		M.	Urine normal. Sp. gr. 1018
	76	20		E.	
24	86	20		M.	Sp. gr. 1016
	78	20		E.	
25	68	24		M.	Ring of albumen with nitric acid; no casts. Sp. gr. 1014
	72	20		E.	
26	68	20		M.	Sp. gr. 1018
	62	18		E.	
27	72	18		M.	Sp. gr. 1020
	80	18		E.	
28	86	18		M.	Albumen diminishing. Sp. gr. 1020
	86	20		E.	
29	80	18		M.	Sp. gr. 1018
	84	20		E.	
30	80	18		M.	Sp. gr. 1018
	84	20		E.	Urine normal.
July 1	74	18		M.	Sp. gr. 1020
	76	19		E.	
2	78	18		M.	Sp. gr. 1020

97° 98 99 100 101 102°

Fig. 308.—Temperature chart of C. H., aged 20. Superficial burns of face, neck, shoulder, and hands. First and second degrees. Recovery.
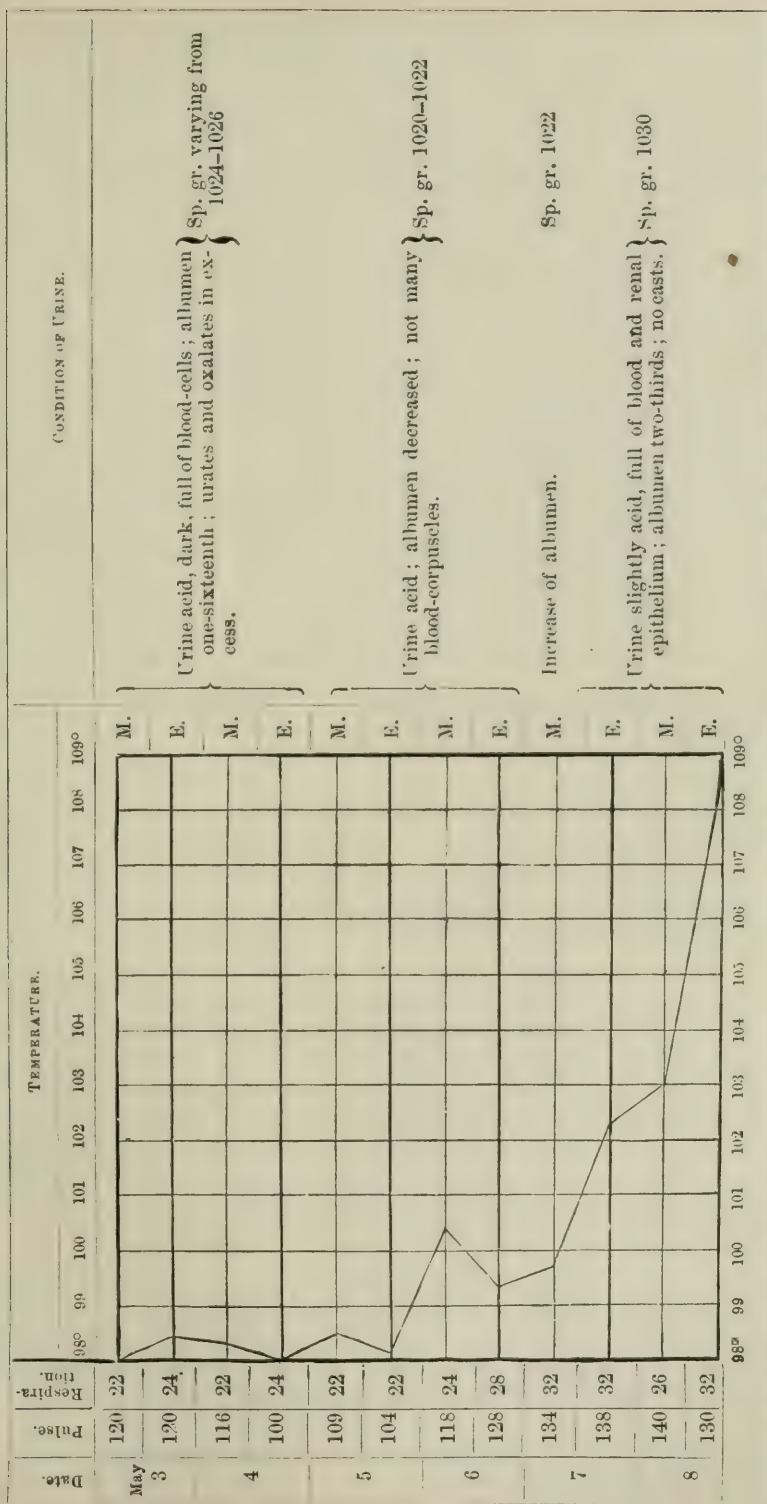
Fig. 309.—Temperature chart of C. L., aged 18. Superficial and deep coal-oil burns of half surface. Temperature 108.6° at time of death. No autopsy allowed.

ature rises, during an exacerbation of fever, the albuminuria is again present, the fluctuations being due to some irritation which causes an increased congestion of the kidneys, from either a lessening of the surface blood or of that of the intestinal tract, or from a general increase of arterial tension. Albumen may also be found in the urine at once after the reception of a burn, without any increase in temperature; in fact, it appears even during the shock incident to the injury, when the temperature of the body is below the normal standard. This is well seen by an examination of the chart shown in Fig. 309.

In this extremely interesting and instructive case, a girl, eighteen years of age, was admitted into the Pennsylvania Hospital, May 3, 1881, with superficial and deep burns from coal oil, which involved about one-half of the surface. The temperature was then 98° F., and there was no rise in temperature until the evening of the 5th, during which time shock continued; then the temperature rose to 100.5°, and suddenly advanced to 102.5°, 103°, and then to 108.6°, with death. The urine, drawn upon admission, showed one-sixteenth of albumen, with blood-cells, urates, and oxalates, although the temperature was but 98° F.—a low temperature, which continued for two days; the albumen decreased on the third day, although the temperature had then risen to 100.5°, but the amount of the secretion was augmented; on the fourth day, with the rapid rise in temperature, the albumen increased very markedly, and on the fifth day, the urine showed blood in great amount, renal epithelium in abundance, but no casts; the amount of albumen had increased to two-thirds, and the specific gravity was 1030. When death occurred, the temperature record was 108.6°.

There was in this case evidently excessive renal congestion during the period of shock, which lasted more than two days; then, as the temperature rose, the albumen steadily increased, doubtless with renal inflammation, and as a result the urine showed two-thirds of albumen.

The presence of albumen, it would seem, therefore, should usually be expected in burns and scalds of any severity, or those occupying much extent or depth. *Frost-bite* and burns have so many symptoms in common, and are in so many respects alike, that I concluded to test also the urine of patients suffering from the former condition for albumen, and as the winter of 1880–81 was particularly severe, several cases of frost-bite were received and examined.

The first patient to whom my attention was directed was a man forty-two years of age, who, having slept in an open freight car during a bitterly cold night, was brought to the hospital with severe congestion involving both feet and legs. Upon admission, his temperature in the axilla was 99° F., with considerable shock and notable constitutional depression. After some hours reaction appeared, when it was at once evident that the circulation was entirely obstructed in both limbs from a point just below the knee. The urine, upon examination immediately after admission, was found to be normal, but soon, coincidently with the rise in temperature, became markedly albuminous, though it contained no casts. When the line of demarcation had formed, the albumen disappeared, and was not again observed.

On the 31st of December, 1880, a man, thirty-nine years of age, was admitted into the Jewish Hospital, under the care of Dr. A. Schapringer, with frost-bite of both feet. The parts were discolored, sensation was absent, and bullæ had formed. On examination by heat and nitric acid, the urine showed albumen, and its specific gravity was 1021. The albumen continued present in the urine for several days, and then disappeared.

Falk says that "the inflammation of the kidneys and other organs consecutive to extensive burns of the surface of the body is unquestionably produced in the same way as the nephritic inflammation which is due to

catching cold. It is well known that destruction of the skin produced in this way, when extensive, causes a general depression of the bodily temperature in consequence of the great loss of heat: it acts in the same way as a continued abstraction of heat by cooling of the uninjured skin." He says, also, "that the inflammation of the internal organs following extensive burns is due to the destruction of the red blood corpuscles which were present in the vessels at the site of the injury, and were thus exposed to the excessive heat, is not supported by a sufficient number of positive facts." He believes that "the morphotic fragments of the destroyed blood-cells, together with the chemical products of their decomposition, are swept with the current of the blood into the affected organs, and there excite inflammation."[1]

COMPLICATIONS OF BURNS.

INTESTINAL COMPLICATIONS.—Intestinal catarrh, inflammation, and ulceration, may, as is well known, be excited by any cause which suddenly drives the surface blood inward, and thus in burns and scalds we may have produced in a similar manner the various grades of intestinal complication, from the simplest gastric and intestinal irritation with diarrhœa, to a high grade of inflammation and ulceration of stomach or bowel.

"Falk has found, in cases of burns of large extent, broken-down corpuscles in the blood, and a depressed action of the heart; conditions which may help to explain the singular reciprocal relation between intestinal inflammation and burns of the skin."[2]

Dupuytren was the first to point out that, in patients dying between the third and eighth days after burns, the brain, bowels, and lungs were frequently congested, and sometimes inflamed, and that the mesenteric glands and mucous membrane of the intestines were also found in some instances actually ulcerated, fatal results following during the suppurative period.

Ulceration of the Duodenum.—In 1842, Mr. Curling, of London, read a paper before the Royal Medical and Chirurgical Society "On acute ulceration of the duodenum in cases of burn." The subjects of the disease, in the cases reported, were young, the eldest having been twenty-eight years of age, whilst the ages of the other nine varied from three to nineteen years. "The ulcerative action was evidently of an acute character, a fatal termination having ensued in from seven to seventeen days after the injury in all the cases except one, in which the patient survived till the end of five weeks." In these cases the ulceration went on to perforation, giving rise to peritonitis; hemorrhage from lesion of a bloodvessel occurred in six cases; the fact that the ulceration usually takes place, as Mr. Curling says, "in that particular part of the duodenum, where it passes in front of the head of the pancreas, renders these cases very prone to the occurrence of hemorrhage, owing to the arteria pancreatica duodenalis running so close to the walls of the intestine in its passage between the duodenum and the pancreas as almost necessarily to become exposed when perforation ensues." In the cases described, the ulceration was usually found close to the pyloric orifice; in some instances within a quarter of an inch of this opening. Usually there was but one ulcer, sometimes two or three. In two instances the mucous membrane was deeply injected, but without ulceration; and again there were found unequivocal marks of circumscribed inflammation of the mucous membrane anterior to the head of the pancreas.

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[1] Ueber einige Allgemeinerscheinungen nach umfangreichen Haut-verbrennungen. Archiv für Path. Anat., Bd. 53, H. 5, S. 27.
[2] Ziemssen's Cyclopædia of Practical Medicine, vol. vii. p. 364. (American edition.)

Mr. Curling described these ulcers as being circular, oval, or sometimes quite irregular in shape, in size equalling a shilling or a half-penny, and again only five, or less, lines in length, by a line and a half, or more, in breadth; and he believed that the sudden arrest of the functions of the skin brought upon the duodenal glands an increased action, and that the irritation consequent to this led to inflammation and ulceration. Since then, though the subject has received much attention, yet the occurrence of this form of ulceration after burns and scalds has been involved in considerable obscurity, so much so that many surgeons have doubted the existence of this pathological change; however, it has been very conclusively demonstrated now that not only duodenal but gastric ulcers do result from burns and scalds. Changes in the condition of the gastric juice brought about by various causes would seem to be sufficient, under certain circumstances, to permit, according to some authorities, a digestion of the intestinal or gastric walls; but such lesions must not be confounded with spots of post-mortem digestion of the walls of the stomach or duodenum.

Any derangement or local arrest of circulation which may cause blood stasis, is believed to be sufficient to produce this peculiar lesion, and even to bring about ulceration. Thus an interference in the normal surface circulation, taking place after extensive burns and scalds, has been held to induce such vascular disturbances in the walls of the intestine or stomach, and to produce ulceration, a lesion which "Falk regards, as mainly due to the inhibition of the gastric circulation, resulting from the depressed action of the heart."[1]

Ziemssen, when referring to the cause of duodenal ulcer, says that the pathological change is always due to the action of the acid gastric juice; that the primary lesion is a local arrest of circulation, and that the formation of the ulcer at this point is a secondary and necessary result of the action of the digestive juice. Hemorrhagic necrosis of the mucous membrane, producing derangements of circulation, as stated by Virchow, has been directly demonstrated by a case "which showed at the autopsy an embolized artery in the base of a duodenal ulcer." This author also states that the prototype of the peptic ulcer is the perforating ulcer of the duodenum, and that the etiology of the gastric ulcer is identical with that of the duodenal ulcer, inasmuch as the latter is undoubtedly always due to the action of the acid gastric juice; that gastric ulcers are produced by a great variety of causes, all of which act by interrupting the local circulation, in consequence of which the acid gastric juice can impregnate the wall of the stomach [and duodenum] to a greater depth and digest it, while, under normal circumstances, the blood circulating in the tissues renders them constantly alkaline, so as to protect them from self-digestion.

Rindfleisch,[2] when referring to hemorrhage as the probable cause of the development of simple (chronic, round, and also perforating) ulcer, says:—

" The extravasated blood-corpuscles infiltrate a circumscribed section of the mucous membrane in such measure that the blood capillaries are compressed and nutrition ceases with the circulation. The hemorrhagic infarction becomes a *caput mortuum;* its organic connection with the healthy mucous membrane is destroyed, and the actual separation [is] yet only a question of time. If, however, we reflect that the gastric juice dissolves such dead portions with facility . . . . we will find it conceivable that already, but a few hours after the hemorrhage, instead of the infarction, we will meet with those clean, sharply defined losses of substance that Cruveilhier called *érosions hémorrhagiques.*" " The simple ulcer, therefore, takes its departure from a hemor-

[1] Ziemssen, op. cit., vol. vii. p. 204.
[2] Text-book of Pathological Histology, etc., page 356. Philadelphia, 1872.

rhagic infarction. . . . If the infarction has been dissolved and removed (digested) by the aid of the gastric juice, there remains behind a correspondingly large loss of substance; the *ulcus simplex* is established. From this time out it may enlarge and may attain the dreaded developmental climax of a perforating ulcer. Upon the other hand, it may also become smaller and cicatrize. . . . The round form of the deficiency belongs prominently to these essential peculiarities. . . . The deficiency has the form of a very flat cone, whose base is situated at the surface of the mucous membrane, whose apex is eccentrically situated in a deeper layer of the gastric wall." As to the causes of " this funnel-shape formation, the answer again points us to the hemorrhagic infarction as the point of departure of the disturbance."

Hemorrhagic erosions of the mucous membrane of the intestine and perforating duodenal ulcerations have been frequently observed by Rokitansky; but, on the other hand, Caspar states that he " has never observed these phenomena in a single case of death from burning." This interesting pathological change in the duodenum has, for a few years past, been carefully sought for, and there is no doubt that under certain circumstances this ulceration or degeneration may rapidly occur. The ulcer is described by Ziemssen as very similar to the ordinary gastric ulcer, which also occurs from burns; as having " a sloping shape like a terrace, resulting from the fact that the loss of substance in the *serosa* is less than in the *muscularis*, and in the latter less than in the *mucosa;*" the edges are sharply cut, not thickened, and in the older ulcers are indurated, in consequence of reactive inflammatory processes in the vicinity. The *base* " shows no trace of suppuration, and is formed by the *muscularis* or the *serosa* according as the ulceration has penetrated more or less deeply."

The ulcer generally is free from any surrounding inflammation. The presence of blood in the stomach or bowels would suggest the presence of an ulcer in some part of the intestinal tract.

The symptoms which, during life, in a case of burn, would lead the surgeon to suspect the existence of a duodenal ulcer, are simply of a negative character: pain in the epigastrium, possibly tenderness upon pressure, hæmatemesis, blood in the evacuations, and a sudden collapse, would at least give rise to the suspicion of ulceration; while vomiting or diarrhœa might also readily exist, with simple gastric or intestinal irritation. Death from duodenal ulcer has been reported as early as the fourth and as late as the sixtieth day; youthful subjects, it would seem, are more frequently than older persons affected by this particular form of ulcer, although quite a number of instances are reported as having occurred in those of advanced years. In one case given by Mr. Curling, of a child three years of age, who died on the fifth day after severe burns, duodenal ulcers were found; one ulcer, having perforated into the abdominal cavity, gave rise to peritonitis and severe hemorrhage. On the other hand, deaths with ulceration have been noticed in patients of sixty and seventy years of age. There is no specimen of this form of ulceration in the museum of the Pennsylvania Hospital, and Professor Leidy informs me that the same may be said of the Wistar and Horner Museum of the University of Pennsylvania, and of the Mütter Museum of the College of Physicians of Philadelphia. None of the post-mortem examinations at the Pennsylvania Hospital has produced any specimen of this lesion, nor has there been during the past twenty years, as far as is known, a death from internal hemorrhage after such injury. Although there can be no doubt that such ulcers occasionally occur, yet it is probable that fatal results from them are very rare. In a late fatal case of burns at the Pennsylvania Hospital, a woman had extensive injuries from her clothes taking fire, three hundred and sixty-nine square inches of surface having been deeply burned. She perished on the forty-sixth day from exhaustion, and an

examination showed the duodenum to be perfectly healthy. It is probable that cicatrization of the ulcer occasionally takes place: Mr. Holmes reports the case of a child, three and a half years of age, who, on the twenty-eighth day of severe burns, died from pneumonia, when, at the autopsy, "a circular patch about the size of a four-penny piece was found at the commencement of the duodenum, where the mucous membrane was deficient and the exposed surface was cicatrized." An interesting case of duodenal ulcer, which occurred in this city some years ago, was seen by Dr. S. W. Gross, who has given me the following particulars:—

The case was one of exhaustion from opium poisoning, and the medical man in attendance, in order to induce reaction, placed bottles of very hot water along the patient's limbs and side, and injected hot water into the rectum. So vigorous was the treatment that the precautions in the physician's instructions against burning the patient were overlooked, and destructive inflammation followed, with extensive sloughing, not only of a large portion of the skin of the lower extremities, but also of the mucous membrane of the rectum. The patient, however, did well until the twenty-first day. when suddenly he was seized with abdominal pain, and death supervened in twenty-four hours. The post-mortem examination showed general peritonitis, and also disclosed an ulcer of the duodenum, opposite the entrance of the ductus communis choledochus.

COMPLICATIONS INVOLVING THE RESPIRATORY ORGANS.—Laryngitis, bronchitis, or pneumonia, may occur as a result of burns or scalds; the first not infrequently follows the inhalation of hot steam. The symptoms are characteristic: aphonia, dyspnœa, and great pain. Œdema may occur suddenly with most alarming symptoms. Cases have been reported in which tracheotomy has been performed, in order to avert impending death. Pneumonia and bronchitis are not infrequently developed in the course of burns, especially in those of the chest and neck.

CEREBRAL COMPLICATIONS.—In the early stages of these injuries, evidences of cerebral irritation often appear: inflammation may occur, with effusion, accompanied by violent delirium; and convulsions and coma are usually observed before a fatal termination. Delirium does not always indicate inflammation of the brain or its meninges; for even in the less serious cases of burn or scald, it is not uncommon to have traumatic delirium, or surgical fever, of a mild form coming on early after the injury, appearing usually towards evening, and recurring at varying intervals; besides, the uræmic condition incident to the albuminuric state, with low specific gravity of the urine, would in many cases readily account for the cerebral symptoms.

Various complications may arise, as in any other form of injury, at almost any time during the course of the treatment: among these may be mentioned tetanus; simple or phlegmonous erysipelas; hemorrhage, from sloughing, which may open either arterial or venous trunks; joint complications, from the opening by sloughing of articulations of greater or less magnitude; and contractions. When a large extent of skin has been lost by either a burn or a scald, contraction necessarily occurs; if the lost tissue is in the vicinity of the bend of a joint, as the elbow, wrist, or knee, the contraction which follows seriously impairs and sometimes entirely destroys the function of the part, and in healing leaves most terrible deformity.

PROGNOSIS OF BURNS.

When the skin and subcutaneous tissues are acted upon by caloric in an intense and active form, certain morbid conditions result, the prognosis of

which varies according to the intensity of the applied heat, the nature of the medium, the extent of surface involved, as well as the age, temperament, and constitution of the patient. Burns of the first and second degrees generally result favorably, the patients recovering rapidly; in those of the highest degree, however, when the surface involved is very extensive, the prognosis is more grave, and, indeed, from the great extent of surface involved, even burns of the first degree may prove fatal. It is generally accepted that, if one-half or even one-third of the surface has been burned or scalded, death, from some physiological cause as yet not thoroughly explained, will be inevitable; and this result usually occurs within the first twenty-four or forty-eight hours. Even with a less extent of cutaneous surface involved, the prognosis should be guarded. In burns of the third degree, which are only caused by the application of intense heat, the prognosis will depend not merely upon the depth to which the tissues have been destroyed, but upon the region or part of the body involved, as well as upon the sex, age, temperament, and previous constitutional condition of the patient. Fatal results are sometimes observed even after slight burns of the third degree, especially in the cases of children and old people.

During the past twenty years, at the Pennsylvania Hospital, there have been 220 deaths from burns and scalds, 122 of which occurred within the first forty-eight hours, while 74 perished between the second and the fourteenth days; 21 between the fourteenth and the thirtieth days; and the three remaining cases respectively on the 38th, 54th, and 115th days. Of 1554 cases of burns or scalds treated in the same institution, 417 in all have ended fatally—a mortality of about 26 per cent. In the last series of 258 cases, 71 patients have died; of these 45 perished from shock, 15 from exhaustion, 3 from bronchitis, 4 from tetanus, and a like number from traumatic delirium. There were 45 deaths within the first twenty-four hours after the patients' admission; 16 of the remainder prior to the eleventh day; 9 between the eleventh and the twenty-fourth days; and one on the forty-sixth day, from exhaustion and diarrhœa. Of the 258 cases, 91 were scalds from steam, hot coffee, etc.; 63 from burning petroleum; 43 from grates, fires, stoves, or furnaces; 29 from miscellaneous causes; 20 from explosions of gunpowder, or blasting; 7 from boiling lard, soaps, or syrups; 3 from oil of vitriol, muriatic acid, or lime; and 2 from molten iron. The mortality in this series of cases was a little more than 27 per cent.

It is perhaps fortunate, as well for the patient as for the hospital, that the subjects of the more severe and quickly-fatal burns and scalds die during shock within a very short time, as they often do, without experiencing pain; for at this time the sensibilities are all blunted, whereas whenever partial reaction occurs, the suffering is excessive, and but little can then be done to make the patient's brief existence at all bearable.

TREATMENT OF BURNS AND SCALDS.

In the management of burns and scalds, the treatment will vary in accordance with the severity of the injury; the indications, however, are at once to relieve the pain, and to overcome shock; subsequently, to guard against congestions and inflammations of internal organs; and still later, in the third stage, to counteract the exhaustion incident to sloughing and the various other sources of depression; to support the patient's strength by a plentiful supply of nourishing food, combined with the judicious use of stimulants, and associated with quinine, iron, and the mineral acids. In burns of the *first degree* there are usually no constitutional symptoms which require special treatment, though now and then, from the great extent of surface involved, there is shock, which rest and anodynes soon relieve. The local

symptoms, however, are frequently quite severe; the burning pain, the hyperæmia, and the serous effusion are best relieved by applications of unguentum petrolei (cosmoline), or of olive oil with carbolic acid; or by the use of cold, if an extremity is alone involved, or of alkaline lotions, especially of the bicarbonate of sodium; the latter substance, if finely powdered and dusted over the burn, has a remarkable influence in reducing pain. Other soothing dressings, frequently used, are lard and the benzoated ointment of the oxide of zinc.

The treatment of *shock* after burns and scalds should be conducted as in other cases, by the application of artificial warmth, and by the enforcement of rest—the latter being a most important factor in securing reaction; the patient should be disturbed as little as possible, and, as a rule, an anodyne should be given at once. Opium, hydrate of chloral, or morphia may be given by the mouth, or the extract of opium by the rectum; hypodermic injections of morphia are preferable in most cases. These can be repeated until the pain is controlled. In excessive shock, spirit of ammonia or ether should be given internally, or by hypodermic injection; alcoholic stimulants should be given in only small quantities, by the mouth, and, if the symptoms of depression are not very marked, their exhibition is unnecessary.

When *reaction* has commenced, hot coffee, beef-tea, and milk-punch should be given in small but frequently repeated doses. With decided reaction, milk and beef-tea should be given in larger quantities; as a drink, the former should be combined with lime-water, if the stomach continue irritable. Thirst, which is usually intense, should be allayed by allowing the patient to suck small pieces of ice, or to sip small quantities of champagne or carbonated water. During the early dressings of the injured parts, great care should be taken to avoid all unnecessary and prolonged exposure, and consequent chilling; for inflammations and congestions of the internal organs are likely to occur during this period. *Constipation* is not uncommonly observed during the first two or three days following a burn or scald, and, should a laxative enema not produce a sufficient evacuation from the bowels, a mild aperient or effervescent saline should be given. The various *congestions of internal organs* require treatment in accordance with the part affected; as a rule, opium in some form is habitually and daily required to procure sleep, if not to relieve pain. *Cerebral hyperæmia* with *delirium* is sometimes seen after burns, as a result of vaso-motor paresis; similar symptoms of a mild type have occasionally been observed after exposure to the intense rays of the sun. In the treatment of cerebral hyperæmia from such causes, there is no application more potent in counteracting this morbid impression than the continued warm bath, of a temperature of 95° or 100° F., as recommended by Hebra, with the internal use of the bromides in preference to opium. If the general baths are not readily obtained, a sitz-bath or foot-bath can be substituted, simple or medicated, with salt or mustard. *Tetanus* after burns is nearly always fatal; in such a complication, either morphia, conia, or the hydrate of chloral and the bromides should be administered in sufficiently large doses, and, in more violent cases, ether or chloroform should be given by inhalation.

Gastro-intestinal irritation often calls for alleviation. At first, moderate diarrhœa is often somewhat of a relief, but it may afterwards appear during the exhaustion incident to profuse suppuration, and, if so, it is best combated by opium combined with astringents, and by bismuth and pepsine. Great care should be taken in the administration of food on account of this irritability of the intestinal tract. The Castillon powders are exceedingly beneficial for this purpose; they are best given in boiled milk, and are composed of pow-

dered tragacanth, sago, salep, sugar, of each one ounce; prepared oyster-shell two drachms; to be divided into one drachm powders. This affords a most nutritious food, and at the same time a most excellent corrective to a relaxed intestine. *Inflammation of the air-passages* as a result of the inhalation of steam, alone or combined with carbonaceous and sulphurous fumes, and other noxious gases, not infrequently proves fatal. Bronchitis, pneumonia, and pleura-pneumonia, particularly in young subjects, are apt to result, especially from burns and scalds involving the chest and neck. Of all abdominal organs, the *kidneys* seem to be most commonly affected in the course of burns and scalds, and at an early period. As has already been said, if the urine be examined when the temperature rises to 101.5° or 102° F., albumen will be found, and, in accordance with the rise in temperature will the quantity of albumen be increased; and in proportion to the amount of albumen, the case assumes a grave character. The alkalies are here indicated, combined with sweet spirit of nitre, or the spirit of Mindererus, or any other mild diuretic. The patient's room should be kept as nearly as possible at a uniform temperature.

LOCAL TREATMENT.—When a portion of the cutaneous surface has been injured by heat, although the repair which follows is in no manner different from that which occurs after an injury or destruction of skin from other causes, yet the peculiar symptoms incident to burns and scalds require special forms of treatment; and the applications which are most esteemed are those which speedily relieve or prevent pain, and are at once emollient, soothing, and disinfectant in their nature.

Carbolic Acid seems to possess in a very remarkable degree the property of lessening or entirely overcoming pain when brought into contact with burned or scalded surfaces, and, when combined with cosmoline or olive oil, it affords an application which possesses qualities eminently appropriate to the treatment of burns. In addition to the relief from pain experienced by the use of carbolic acid, its disinfectant power is, in this special class of cases, of great value. For many years past, in the Pennsylvania Hospital, all cases of burns and scalds have been treated with carbolic acid in some form or other; the preparations most commonly used are carbolized cosmoline, carbolized olive oil, and, occasionally, the oxide of zinc ointment combined with the phénol. The carbolized cosmoline consists of the ordinary ointment of petroleum, with five per cent. of crystallized carbolic acid. The carbolized olive oil consists of eleven parts of pure olive oil to one part of Calvert's liquid carbolic acid, No. 4. In some cases of extensive surface scalds, the benzoated oxide of zinc ointment has been used in the proportion of thirty parts of the zinc ointment to one part of Calvert's carbolic acid, No. 4, but the first two mixtures are made in accordance with recognized house formulæ, and have been used almost exclusively in the treatment of each and every form of burn or scald brought into the hospital. Carbolized water for irrigation is made in the uniform strength of one drachm to the pint; it is in constant demand in the surgical wards.

These preparations fulfil all the indications required. The carbolic acid unquestionably produces more or less surface anæsthesia, and thus acts most beneficially; and with the cosmoline or olive oil forms at once an eminently soothing, agreeable, anodyne, and disinfectant dressing—one which can be readily applied, and which, as it does not become dry, can be removed with little or no pain. In using the carbolized oil or the cosmoline, portions of old linen or lint are torn into strips, and after being thoroughly saturated are laid upon the injured surface, and may, if desired, be covered with waxed-paper or oiled-silk, when by a few turns of a roller bandage the dressings

can be readily kept in position. In the hundreds of cases in which carbolic acid has been thus used at the Pennsylvania Hospital, no instance of poisoning by its absorption has been noticed.

It is well to bear in mind that only one part of a burned patient should be exposed and dressed at a time, in order to avoid surface chilling; and that the greatest precaution should be used not to tear away any burned portion of clothing which adheres to the injured surfaces, lest the cuticle should be also torn off. A few applications of the carbolized oil or cosmoline will quickly cause a separation of any attached portions of clothing.

Vesicles or bullæ should not be broken, but may be punctured at their lowest point in order to prevent them from bursting; their contents should then be very gently pressed out, or allowed to slowly drain off, and care should be taken that the cuticle is not afterwards rubbed off, as it affords the very best covering for the excoriated surface. Dressings as a rule need not be changed oftener than every second, third, or even every fourth day, unless the amount of suppuration is very great, or the odor quite marked. When the gangrenous parts have been thrown off by the sloughing process, the ulcerated surfaces beneath are usually soon covered with florid granulations, which may require restraint by astringent applications, and compression by means of adhesive plaster. If, in a person of a weak constitution, the granulations should be pale and weak, a stimulating plan of treatment should be adopted. In the treatment of burns and scalds, however, of all kinds and of every degree, from first to last, in the young as well as in those advanced in years, the general symptomatic treatment and the local use of carbolized olive oil or cosmoline, have secured at the Pennsylvania Hospital, under all circumstances and conditions, the most satisfactory results.

During the healing of the ulcerated surfaces about the flexures of the joints, between the fingers, about the face, neck, etc., much good can be accomplished, and subsequent deformity may often be avoided, by keeping the various parts carefully separated and in appropriate position, either by fixation upon *splints*, or by appropriately adapted *mechanical appliances*. Many ulcers from burns which formerly were found very indolent, or from their position and size could not be made to cicatrize, and were indeed deemed incurable, are now rendered amenable to treatment through the agency of *skin-grafting*; or even, in some instances, by the method of *transplantation of skin* recommended by Wolfe.

Innumerable are the remedies which have been from time to time advocated for the local treatment of burns and scalds; those, however, which have been found most beneficial are such as act more especially as protective coverings by excluding atmospheric air, which is always irritating to an excoriated or inflamed skin. Among them may be mentioned flour, starch, oxide or carbonate of zinc, cotton wadding, fixed oils, white lead paint, etc. *Cold water dressings* are most soothing; yet cold is only applicable to limited portions of the body. *Flour* is very frequently used in burns, and as it is so easily obtained, forms a common household remedy; it should be dusted over the burned or scalded parts not only freely but uniformly, so as to form a soft, thick, and soothing covering to the surface. The parts should next be enveloped in layers of *cotton batting*, the application of a roller bandage then keeping the dressings in position; a crust soon forms with the serum which exudes from the excoriated cuticle, and this ordinarily should not be removed until a separation is produced by the discharge itself; or, if desired sooner, the dried crusts may be moistened and softened by the application of olive oil, the white of eggs, or of a thin, soft, flaxseed poultice. After this the exposed surfaces may be dressed with any emollient dressing. *Carron oil*, which is even yet extensively used all over the world, consists of equal

parts of linseed oil and lime-water: it is certainly a very valuable and an eminently soothing dressing; but its very offensive odor and the greasy look of the patient's clothing and bedding which it produces, have deterred many from employing it.

The addition to this preparation of a small amount of the oil of turpentine, is said to greatly enhance its efficacy. Carron oil was used very extensively in the wards of the Pennsylvania Hospital until the carbolized oils were substituted for it several years since. Many surgeons have advocated the use of *white lead* as a primary dressing, and refer in the most favorable manner to the application of carbonate of lead ground in linseed oil: the white lead paint is spread thickly upon lint, and laid over the denuded or burned surfaces, and it would seem from the reports of the cases in which it has been employed, that no symptoms arose indicating the absorption of lead.

A mixture of *collodion* and *castor oil* has been recommended by Savage. If painted over the surface several times a day, this forms an excellent coating, and, although painful upon the first application, is said to be afterward exceedingly grateful, protecting the parts from the air more thoroughly than anything else. *Iodoform*, with the extract of conium, spermaceti, and carbolic acid, is said to act as a decided sedative, at once lessening pain, inflammation, and suppuration. The ointment should be spread on linen, and applied over the surface: the same objection which exists to the use of other ointments holds good in this case, namely, that the ointment is frequently separated by the heat of the parts, and that the cloths become dry, and stick along the edges of the inflamed cuticle, and, during their removal, give rise to great pain. The following formula is recommended by Dr. Bedford Brown, of Alexandria, Virginia: R. Iodoformi ʒij, unguent. cetacei ʒj, extracti conii ʒjss, acidi carbolici gtt. x.–M. Sig.—Spread on linen. Dr. Shrady, of New York, has advocated a paste made up of gum Arabic ʒiij, tragacanth ʒj, carbolized water (1 to 60) Oj, and molasses fʒij, which is applied with a large camel's hair brush; three or four applications are sufficient, it is said, to allay all the pain of these cases. The use of stimulating applications in burns and scalds is frequently very beneficial, and is of great antiquity, Hippocrates having used an ointment made of lard, resin, and bitumen. Mr. Kentish recommended an ointment, which has since borne his name, composed of resin ointment and the oil of turpentine: this preparation, with slight modifications, is still in frequent use.

Lard, which can be so readily obtained, is at once a most soothing and agreeable dressing; the salt which it always contains can readily be removed by washing in cold water. It should be applied frequently and liberally. A solution of the *nitrate of silver*, made in the proportion of three or four grains to the fluid ounce of water, was highly recommended by the late Mr. Skey; it causes when first applied considerable pain, but this is only momentary; there is subsequently entire relief from suffering, and crusts of a brownish-black color soon form upon the denuded surfaces.

Dr. G. F. Waters, of Boston, has used with great success the dry *bi-carbonate of sodium* as a local application to burns and scalds. The soda should be sprinkled over the injured part, and over this a wet cloth should be applied; under this plan of treatment the pain is said to be "almost immediately relieved, and the healing process goes on rapidly."[1] Finely-powdered *wood charcoal*, if applied at once to burned or scalded surfaces, is said to be not only grateful to the patient, but to afford a speedy remedy, relieving pain as if by magic, and preventing bad odors. In a large iron-mining and smelting

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[1] Medical Record, vol. 12, p. 672, 1877.

company in Styria, cases of burn are treated very successfully, it is reported, in the following manner:—

The wound is first cleansed (without opening the blisters), then disinfected with a two per cent. solution of carbolic acid, and covered with a thick furniture varnish, prepared from linseed and litharge, in which five per cent. of salicylic acid has been dissolved by warming. The varnish is allowed to dry, and another coat applied ; over this is placed a layer of Bruns's cotton, about two-thirds of a centimetre in thickness. The wound seldom suppurates, generally healing under the varnish, which is finally removed as a dry pellicle, no change in the dressing having been necessary. Should. however, the occurrence of suppuration be threatened by the setting in of fever, or by the occurrence of pain, the dressing is removed from the affected locality ; if the spot be not over five centimetres in diameter, nothing further is done but to strew the moist surface with dry salicylic acid powder ; if larger, an opening is cut in the dressing ; the salicylic acid is applied as before, and it is then covered with a fresh layer of cotton. The scars become, by this method, entirely smooth and white, and are not hypertrophied.[1]

In burns and scalds of the first or second degree, which involve a large extent of surface, the *continuous tepid bath*, of a temperature of from 90° to 100° F., has been recommended by Hebra. This form of treatment, under which rapid recoveries are reported, can be kept up for days or even weeks at a time, if required. If the *antiseptic method* of treatment be used in burns and scalds, the parts are first thoroughly disinfected, and then entirely covered by Lister's boracic acid, which is spread on linen, and then completely enveloped in the carbolized gauze or in salicylic cotton; under this form of treatment, the devitalized parts, it is said, not only separate most satisfactorily, but the resulting cicatrix, instead of assuming the characters commonly observed in such tissue, remains smooth and elastic, and is not apt to undergo contraction.

Treatment of Burns from Corrosive Acids, Caustic Alkalies, etc.

The action of corrosive acids and caustic alkalies upon the tissues is similar to that occasioned by the application of intense heat, causing local destruction, which is repaired by granulation, as in an ordinary ulceration of the surface, after the separation of a slough. The corrosive or mineral *acids* which most frequently occasion burns are the sulphuric, the nitric, and the muriatic. In chemical works and in other places where these acids are in common use, burns of the surface are of not infrequent occurrence, and it is the experience of workmen so injured that, in the immediate treatment of such an injury, the application of water is to be avoided, as it causes, when mixed with these acids, a great and sudden elevation of temperature. The proper plan is to instantly apply whiting, or levigated chalk, which causes brisk effervescence and at once neutralizes the acid ; after which the mixture may be washed off with water. If this be done promptly, no burn will result, or there may be mere erythematous redness, with a slight sense of tingling or smarting. Those acid salts which, in solution, are so much used in the arts—the chlorides of zinc and of tin—are occasionally spilled upon the skin, when the resulting injuries should be treated as though they were burns of the acid of which the zinc or the tin forms the base, namely, muriatic. Should any of these substances be splashed into the eye, the organ should be well bathed with lime-water, and the subsequent irritation treated in the usual manner. Occasionally these caustic acids or their acid salts are

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[1] London Medical Record.

taken into the mouth, or swallowed, and, if not promptly treated, cause very rapid and extensive destruction and speedy death. The carbonates of sodium, potassium, calcium, or magnesium are the antidotes, and should be given liberally; on account of the violent effervescence caused by the decomposition of the alkalies, they should be used with great caution, for fear of serious sudden distension or laceration of the injured tissues. Care should be taken, especially when the acid ingested has been the sulphuric, not to flood the stomach with water, which, though it dilutes the acid, also suddenly raises the temperature. In any case, after the administration of neutralizing or decomposing antidotes, the stomach-pump should be used, with great care, for fear of causing rupture of the stomach; large draughts of milk may be used, and vomiting encouraged, but violent retching should not be permitted.

The caustic *alkalies* are soda, potassa, ammonia, and quicklime. These act by suddenly abstracting moisture from the tissues with which they are brought into contact, and they cause a burn, if in a state of concentration, such exactly as would be produced by the contact of heat or strong acids. The domestic manufacture of soap brings caustic potassa and soda into many dwellings under the name of " concentrated lye," and frequent casualties are the result. A recent burn of the surface from these agents should be treated by the application of vinegar, or any other mild acid, which neutralizes the alkali, forming a salt which is non-irritating; a burn of the eye should be treated in the same manner, care being taken to dilute the acid to a proper degree. If vinegar be not at hand, any of the fixed oils or fats would be an appropriate application, their fatty acids combining with the alkali to form a soap. Failing this, if the caustic be soda, potassa, or ammonia, plenty of water should be used so as to dilute the caustic, which it does without causing any increase of heat; but in the case of quicklime, vinegar should be relied on, as water, by causing the lime to slake, would act as fuel. Caustic potassa in small rods or sticks is used for making local applications to the fauces or throat, and occasionally a piece of the caustic, escaping from the holder, is swallowed. In such a case a mild acid, diluted with plenty of water, should be given, and the stomach well washed out.

Occasionally a piece of *nitrate of silver* is dropped down a patient's throat. The proper antidote is chloride of sodium—common salt—which forms, with the lunar caustic, an almost completely insoluble chloride of silver. *Carbolic acid* causes local destruction of the tissues with which it is brought into contact, and is a rapidly fatal poison when ingested. It shares with creasote the property of coagulating albumen, which fact indicates the proper antidote, found in almost every house, the white of egg. There is nothing peculiar about a local burn of the surface caused by this agent, except that, as it is a local anæsthetic, its burns, after a few minutes, cease to be painful; it also coagulates the albumen of the integument, causing a white mark where it drops. Burns of the surface from *phosphorus* are sometimes seen, but demand no special antidotal applications, as this agent burns until it is entirely consumed, generally making quite a deep injury. When it has been swallowed, the most rational antidote is the sulphate of copper, which forms with it a very insoluble phosphide; but death in most cases would ensue before this chemical change could be brought about.

TREATMENT OF DEFORMITIES FROM BURNS.

Within the past few years, the advance in conservative surgery has done much towards diminishing the number of cases of deformity incident to burns and scalds, which in former times so commonly occurred. Large ulcerated surfaces are not permitted now to heal up simply through the gradual

processes of granulation and cicatrization, which formerly caused such terrific and incurable deformity, with loss of the function of parts, if not loss of the parts themselves; but, by the aid of skin-grafting and transplantation of integument, large acute or chronic ulcers are now very successfully treated. The treatment of cicatricial contractions depends very much upon the part involved; gradual compression by the aid of adhesive plaster is often followed by excellent results, and before any operation is instituted for the division of such cicatrices, this method should be thoroughly tried. Oiled compresses are also of great service in making the cicatrices more yielding. After bands of contracted tissue have been divided, and the deformity corrected, as far as possible, the exposed surface left by the retraction of the tissues, if considerable, should be converted into a healthy granular surface, and then treated by skin-grafting or by transplantation of integument: the former method, however, will generally be found the more satisfactory.

LIGHTNING STROKE.

It seems to be a fact widely known and generally accepted, that when the human organism is so placed that it receives the direct stroke of lightning, instant death ensues; and this may be laid down as the rule, but it is a rule not without exceptions. Aërial electrical currents, however, in their disruptive discharges, very commonly strike objects in the immediate neighborhood of individuals, and thus it happens that persons happening to be in the vicinity of such discharges are more or less stunned by the shock, and are said to have been "struck by lightning," when in fact they have received only a nervous or induced electrical shock, which may be more or less severe, but is rarely fatal. The fact that so large a proportion of recoveries takes place after so-called "lightning strokes," conclusively proves that such injuries are not from a direct, but from an indirect, stroke.

The majority of deaths from lightning stroke occur in the level, open country, especially on a plain deficient in trees; villages and thickly built-up towns and cities suffer less. In certain portions of our western country, lightning stroke has been very destructive to life, from the notable absence of trees, or high buildings, which, constantly distributing electricity by conduction tend to produce an equilibrium between the earth and the air. It is stated that the *beech* tree (*Fagus sylvatica*) has never been known to be assailed by atmospheric electricity; so notorious is this fact, that it is acted upon by inhabitants of different parts of the world, and in many places it is considered impossible to be struck by lightning if protection be sought under the beech. Herr Kefferstein says that in Germany the oak is very often struck, the beech very seldom, even in those cases where the trees are intermixed. In Denmark the same observations have been made respecting the immunity of the beech tree from lightning.

The effects of lightning stroke are seen not only on land, but also very frequently on water; and even divers under the water are not exempt from dangers from this source. For instance, at Cole Harbor, Halifax, a diver who was at work far under the surface of the water was seriously injured by lightning, which struck a communicating pump; the man when brought to the surface was insensible, but eventually recovered.

The loss of life from lightning stroke throughout the world is annually very great; in European Russia, during seven years (1870–1877), no less than 2270 persons were killed by lightning; in Austria, during the same period, 1700 persons were likewise destroyed; in Prussia, it is stated that upwards of 70 persons are annually killed; in France the average is somewhat higher —10,000 persons are reported as having been struck during a period of nine

and twenty years, and of this number, 2252 were instantly killed; while in the United States, during the year 1870 alone, 202 deaths from lightning stroke were recorded.

EFFECTS OF LIGHTNING STROKE.—The effects of lightning stroke are most interesting, curious, and appalling. When a person is not killed outright, as so often happens, they are direct and remote; the general symptoms observed are usually those of shock; there is often unconsciousness—sometimes coma—lasting from a few minutes to hours or even days; drowsiness may continue for a variable period; the pupils are often contracted, and the conjunctivæ congested; partial or complete loss of sight or hearing, or both, associated sometimes with impairment of the other special senses, is often observed; paralysis of the upper or lower extremities may be more or less complete; anæsthesia of a part, or paralysis of sensation, not infrequently occurs. These palsies may continue for a variable period, but in time recovery usually takes place.

Local Effects.—The tissues may be burned superficially or deeply; the bones may be fractured—the fractures may be compound or even comminuted; limbs or portions of the extremities are occasionally torn entirely off. Lightning stroke often takes the most peculiar course upon the surface of the body; in some instances, its tracks have a fancied resemblance to the branches of a tree, the main stem from which the branches lead off arising at any portion of the body; these areas are often slightly raised, and the skin moderately œdematous, presenting a marked scarlet tint. These lightning traces gradually taper off until the branches are barely observable, being not larger than the merest scratch of a pin; they may diverge in all directions from the place first apparently struck.

CAUSES OF DEATH AFTER LIGHTNING STROKE.—When death is more or less delayed, or occurs some time after a lightning stroke, the fatal result is either from shock, cerebral effusion, or from other injuries, which, from their gravity, lead on to a fatal termination. Post-mortem examinations have revealed hemorrhagic effusions in the various cavities, and under the membranes of the brain, as well as ruptures of the several internal organs; but not infrequently there are no marks of either external or internal violence; the blood after death is said to remain fluid.

An interesting case of lightning stroke, which was brought into the Pennsylvania Hospital within a comparatively recent period, presented some unusual points of interest:—

C. C., aged 25, a seaman, was in Delaware Bay, in a fishing sloop, when a squall arose, accompanied by rain, thunder, and lightning. During the progress of the storm, the patient, whose clothing was very wet, was standing upon deck in his bare feet, having hold with his right hand of the wooden rings of the mainsail. The lightning struck the mast, which it splintered, and passed from it to him. He was momentarily stunned. The course which the lightning had taken along the surface of his body was clearly shown by a distinct tract of burned skin from the right axilla to the left foot. His right sleeve was rolled up to the shoulder at the time, and, though the hand was contused, there was no mark upon the arm. The external manifestations began in the right axilla, from which the hair was singed, and from this point a linear burn of the second degree extended down the side to the groin, where it crossed the pubes, scorching the hair, and extended down the inner side of the left thigh and leg to the ankle. The left foot was swollen and tender, but there were no marks upon it. The patient was brought to the hospital soon after the injury; the wounds were dressed with cosmoline; there were no constitutional symptoms, nor palsies, and he was discharged cured on the eleventh day.

Medical literature contains many curious cases illustrating the peculiar freaks of lightning; for instance, Dr. Wilks has reported the following interesting and remarkable case of lightning-stroke:—

A laborer was standing under a willow tree when it was struck; the tree was partially stripped of its bark, and the man was literally taken out of his boots; the latter, although greatly torn and twisted, were left at the foot of the tree, while the man was thrown some six feet away. Although he had been well clothed before the accident, he was, when found, quite naked; his clothing was torn completely into shreds; his watch and chain, from the effects of heat, were almost destroyed; his limbs presented serious burns and lacerated wounds; one leg had sustained a compound comminuted fracture, and there was also a compound fracture of the os calcis on the opposite side. The man was, however, conscious, and finally recovered. From the fact that the man's clothes were thoroughly soaked by the rain, they probably conducted the lightning, and thus averted a fatal result.

It is highly probable that the general introduction of electricity as a motive power, and its use for illuminating and other purposes, will make common a class of injuries hitherto comparatively unknown. Indeed, severe deaths from this novel source have already been chronicled, identical with those hitherto only known as resulting from "lightning stroke" itself. Numerous accidents have occurred from using the electric lamp, for if an attendant touches one of the candles, or the conducting wire, while the current is on, the result is generally disastrous to himself. Other accidents arise from inevitable carelessness, and from employing persons who are unskilled and unacquainted with the danger which is incurred in the careless handling of the necessary appliances associated with the powerful batteries: deaths have thus resulted, and will doubtless continue to occur with increasing frequency.

It is certainly desirable, and may reasonably be expected, that more attention should be given by inventors to secure not only the most brilliant, but also at the same time the most thoroughly safe electric lamp. The following case illustrates a now common form of accident:—

A man employed in one of the large car shops of Philadelphia, while carrying a bar of iron across his shoulder, accidentally brought the metal in contact with the wire which supplied the electric light used in illuminating the shop; he thus received a very heavy charge of electricity, which, although producing no external manifestations, such as a burn or contusion, was sufficiently strong to throw him directly forward several yards from the spot, knocking him down, and causing unconsciousness for more than an hour; some transient paralysis followed, but the man made a good recovery.

A stoker on board the Russian yacht Lividia, when holding an electric lamp, seized the brass rod which runs around the lamp, and at the same time touched the wire which supplied the current of electricity with his other hand; the powerful shock sent directly across his chest caused instant death.

TREATMENT OF LIGHTNING STROKE.—Of the appropriate treatment for lightning stroke, it need only be said that, when shock exists, it demands immediate attention, and should be treated as shock arising from other injuries. Hypodermic injections of morphia may be used, and other cardiac stimulants in guarded doses, especially strong coffee. The prognosis of the palsies of lightning stroke is, as often observed, rather favorable than otherwise. During the unconscious stage, free bleedings have been recommended; but in fact the treatment of these injuries should be conducted upon general surgical principles. The burns of lightning-stroke, which are often detached in their character, from the electrical fluid passing to and from metallic substances in the clothing, are treated as ordinary burns, and experience has shown that the healing process in these cases is in no wise different from that observed in burns from other sources.

THE EFFECTS OF COLD.

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Pernio or Chilblain.

THE sudden application of cold to any exposed part of the body, in a person whose constitution is already debilitated, is liable to be followed by the occurrence of CHILBLAINS: this outcome is the direct effect of cold, in a minor degree, upon a languid circulation. A chilblain, in its mildest form, is attended by a moderate degree of redness in the skin of the affected part, a sensation of heat and itching, and more or less swelling, in proportion to the severity of the exposure. The degree of local irritation varies in different cases, which may, for the sake of convenience, be divided into three classes: (1) those in which there is simply a sensation of heat and itching, with a moderate amount of swelling—the whole affection disappearing almost spontaneously; (2) those cases in which the local swelling is very considerable, and is associated with marked redness of the parts, frequently assuming a bluish tinge, the result of local congestive action—the heat, pain, and itching, in these cases, are decidedly troublesome, although the final result is usually favorable; and (3) those which result from a more extended application of cold, and which, to a certain extent, approach the graver condition known as frost-bite. Small vesicles are seen to arise from the elevated and swollen tissues, and, undergoing rupture, leave exposed surfaces which frequently form sores difficult to heal. Such is not an unusual occurrence with the excoriations found on the hardened cutaneous surfaces of the foot [in which situation cold sometimes seems to act as an exciting cause leading to the development of the curious affection known as the "perforating ulcer"].

This third degree of chilblain was well described, many years ago, by Dr. Thomson,[1] who says:—

"When the serum contained in the vesication is let out by a small opening, a portion of new cuticle is usually formed to supply the place of that which has been separated; but when inflammation is severe, and the affection neglected or improperly treated, the parts which are the seat of vesication are liable to pass into the state of vitiated ulcers. In this state, they yield a thin, ichorous, or sanious discharge, and are in general brought only after a long time, and with much difficulty, to a healthy suppuration. In neglected cases, these ulcers not unfrequently become covered with foul sores, or sloughs. Ulceration often supervenes, and the parts covering the bones are destroyed."

Though sloughing and ulceration of the skin are frequently described as the result of ruptured chilblains, such consequences, in the cold climate of the Ottawa Valley, are seldom observed in either hospital or private practice;

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[1] Lectures on Inflammation, p. 638.

and in fact, the form of minor importance, with slight local congestion attended by itching and tenderness, is that most usually seen. Such attacks are observed in those who, after a moderate degree of exposure to dry cold air, or even cold moist air, suddenly approach the fire to relieve their chilly feelings. The sudden transition of temperature proves too much for the debilitated cutaneous surface, and, as the result, chilblains are produced, the degree of the affection being generally in proportion to the severity and duration of the exposure. The fingers, toes, and heels are liable to suffer most particularly, and those parts of the face usually exposed, such as the ears, nose, and lips. Children are more apt to suffer in this way than adults, and persons of delicate constitution, with languid circulation, and with feeble powers of developing the energy requisite for the production of vital heat, are peculiarly subject to chilblains.

TREATMENT OF CHILBLAINS.—Two questions here naturally arise, viz.: (1) How is it possible to avoid chilblains? and (2) How may they be relieved when formed?

Pernio is often thought to be of such trivial importance, that its treatment is neglected. It is true that in ordinary cases the consequences are not of much gravity, but, as serious results occasionally supervene, at least a moderate degree of care should be given both to its prevention and to its cure. In order to avoid chilblains, the use of warm flannel stockings for the feet, and likewise of warm coverings for the hands and exposed parts of the face, in those subject to this affection, is necessary. When there is a languid circulation, a moderate degree of friction with a coarse towel or flesh brush will be found of service. Attention to the temperature of the body, as well as to that of the surrounding atmosphere, is of great importance both during the cold of winter and the heat of summer. Any sudden approach to a fire, after being exposed to cold, is most likely to develop chilblains. In our northern climate, a common, and in fact a speedy means of rendering relief, in the milder forms of pernio, is the application of snow with moderate friction; and even the application of iced-water is found to be beneficial under such circumstances. Too vigorous rubbing must be avoided, in order not to remove the skin over the congested parts, which, after being thus treated, must be well dried and covered with flannel. This plan, although not always congenial to the patient's feelings, is found to answer every purpose, and, if necessary, may be aided by the subsequent application of tincture of iodine, where the chilblain is not broken. Camphor liniment, soap liniment with opium, tincture of benzoin, simple spirit, tincture of myrrh, a strong solution of alum with vinegar, a mixture of equal parts of oil of turpentine and balsam of copaiba, a solution containing the liquor plumbi subacetatis, tincture of cantharides (one part to six of soap liniment), carded cotton, and various other substances, have been employed in this affection. After careful observation, I pin my faith more to tincture of iodine, as a local application, than to any of the other remedies so far recommended. Careful drying of the parts, moderate and gradual application of heat, and subsequent careful protection of the surface by warm stockings or flannel, will, however, be found the most important factors in the treatment of these conditions. Should any of the secondary consequences arise, such as ulcerations, etc., these would have to be treated as under other circumstances.

[Mr. T. Smith, of St. Bartholomew's Hospital, London, has called attention to the fact that the burning and itching in chilblains sometimes occurs in periodical paroxysms, and suggests that, if the convenience of the patient should so dictate, the time of the paroxysms might be hastened by dipping the affected part for a short time in a hot bath containing mustard.]

FROST-BITE.

The term FROST-BITE is employed to designate those local conditions resulting from the application of cold, which are both more painful and more serious in their consequences than the lesser varieties which we have hitherto considered. The effect of cold in producing destruction of tissue may be either direct or indirect; more frequently the latter. At first stimulating, the secondary effect of cold is to depress both circulation and nervous power, this depression, if continued for any length of time, so reducing normal vitality as to produce that condition known as frost-bite. The part may be frozen, and yet recover by moderate care; or may be so frozen as to be beyond normal restoration. One of the very first indications of the approach of frost-bite is a sense of numbness, associated with a well-defined loss of power, and of acuteness of feeling. This loss of power is usually first developed in the fingers and toes; the parts most remote from the centre of the circulation and of heat production. [Fremmert, of St. Petersburg, has published some very interesting statistics of frost-bite, by which it appears that in 333 of 494 cases, the lower extremities alone were affected; the upper extremities alone in 105 cases; and both upper and lower extremities in 38 cases. In 12 instances, other parts of the body were involved as well as the extremities, while in only six cases did the extremities entirely escape. The great toes and little fingers were much more commonly affected than any other parts, and the right side of the body more frequently than the left. Men suffered twelve times as often as women, and the most susceptible period of life appeared to be between the ages of 30 and 35. The mortality among Fremmert's cases was 8.5 per cent., pyæmia and septicæmia being the chief causes of death. As many as 222 operations were performed upon 134 patients, 15 of whom endured major amputations of one or more limbs.] A sense of weight about the affected parts, and a feeling of tingling, indicative of gradually diminishing nerve power, are not unusual symptoms in these cases. The frost-bitten parts, when closely examined, are found to have become white and bleached-looking, and are thus readily distinguished from the adjacent normal structures. The icy coldness of the affected tissues, when they are touched, and their complete loss of sensation, can hardly fail, in our low northern temperatures, to suggest the nature of the case. The part frozen beyond recovery, or "frozen to death" as it is usually termed, at first blanched, cold, and insensible, soon becomes discolored and swollen, and gradually passes into a contracted or shrivelled condition; chemical changes follow; a line of demarcation is formed; and the dead and living tissues are ultimately separated. We have in Canada frequent and forcible illustrations of the unaided amputating powers of nature, in the cases of such frost-bitten persons as remain for weeks in the "lumber shanties," prior to being removed to hospital.

CONSTITUTIONAL EFFECTS OF COLD.—The constitutional effects of cold are first stimulating, and subsequently depressing. The circulation is at first increased in force and frequency, and this is associated with a glow of the surface, and with an exhilarated state of the system generally. Shortly afterwards, a sense of pain and uneasiness is experienced; the body gradually becomes benumbed and cold; a sense of drowsiness, simulating the action of a narcotic, steals over the system, and an almost irresistible desire to sleep overtakes the individual, who thus frequently slumbers and dies. During this period, the blood settles in the internal organs; nerve power declines; the respiration becomes heavy and labored; and death takes place, much as

when it results from an ordinary attack of apoplexy. The sedative effect of cold on the general circulation is probably the result of a diminution of the heart's muscular powers.

[The *mechanism of death from cold* has been made a subject of special investigation by M. Lebastard, who finds that it may occur from several distinct conditions; thus, in cases of *sudden and progressive chilling*, the fatal result may be due to cerebral anæmia, while in cases of *slow and continuous chilling*, it results from cerebral congestion; again, in cases of *sudden re-heating*, death follows—as pointed out by Mathieu and Urbain—from embolism due to clots formed by the disengagement of carbonic acid from the blood, and finally, in cases of *partial congelation*, death usually results from congestion, but occasionally from anæmia, both conditions being caused by capillary embolism from clots originating in the injured part.]

As has already been remarked, cold, when first applied to the body, produces a decidedly stimulating effect—this stage soon passing into one of pain and torpor. When no longer exposed to the cold, the bodily heat rapidly returns, and usually exceeds the normal standard. Locally, cold, like heat, which also at first produces an agreeable sensation, interferes with the circulation in the minute vessels of the exposed part, and, in proportion to the degree of interference, we may have simply a painful condition of the parts, without inflammation; or, going a stage farther, slight inflammation, just sufficient to produce the effusion requisite for the formation of a blister. When the cold has been sufficiently long applied to render the parts pallid or white, just as if the blood had been mechanically forced out of them, vesication is not observed. This may be truly considered an important stage of frost-bite, as the final result will greatly depend upon the method adopted in order to restore the threatened vitality of the affected tissues.

Mortification from severe frost-bite almost invariably involves all the tissues of the part affected. It seldom takes place at once, but usually requires several days for its definite results to fully declare themselves. It is not unusual for a frost-bitten part to present quite a good appearance for a day or two, and then to become discolored, passing from a light blue color to a deeper blue, and ultimately to black, and having an unmistakable, gangrenous odor.

As pointed out by Larrey,[1] cold in cases of frost-bite is not the *determining*, but rather the *predisposing* cause of mortification, the occurrence of which is usually immediately determined by a higher temperature. According to this writer, the French soldiers, before the battle of Eylau, did not experience any painful sensation during the continuance of the severe cold to which they had been exposed in the night watches of the early days of February, and it was not until the second day after the battle, when the temperature had risen from —15° R. (—4° F.) to +5° R. (+43° F.), a great quantity of sleet having fallen on the same morning, and having been the forerunner of the thaw which took place in the course of that day, and continued in the same degree for several days, that they felt the first effects of cold, complaining of acute pain in the feet, and of numbness, heaviness, and prickings in the extremities. The parts were scarcely swollen, and of an obscure red color. In some few cases, a slight redness was perceptible about the roots of the toes and on the back of the foot, while in a few others, the toes were destitute of motion, sensibility, and warmth, being already black, and as it were withered.

The cold produced during a thaw is more severe, on account of the accompanying evaporation, than that which is experienced whilst freezing continues. Mr. South inclined to the belief that a greater degree of dry cold, than of wet

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[1] Memoires et Campagnes, t. iii. p. 60. Paris, 1812.

cold, could be endured, and the same is proved by the experience of each Canadian winter.

[Various nervous phenomena have been observed as the result of exposure to intense cold. Larrey mentions that many of the survivors of the retreat from Moscow became hemiplegic.[1] Peripheral paralysis occasionally follows exposure to cold, the nerves most often affected being the radial and facial. Tourraine, Granjux, Pugibet, and other French military surgeons, describe curious cases of syncope, preceded by excessive redness of the whole body, as the result of cold bathing.]

TREATMENT OF FROST-BITE.—The treatment of frost-bite requires great care and caution, in order to bring about in the affected parts a gradual restoration of sensation, circulation, and heat-producing power. The transition must, of necessity, be slow and progressive, in order to avoid those secondary effects which might retard recovery. In restoring frozen parts, the lowest degree of temperature which can be at first applied is always the safest, and this may be increased slowly, approaching towards the normal standard of the body, as sensibility in the parts is regained. A customary practice in the coldest climates is, first to rub the parts with snow, and in most cases of superficial frost-bite this is productive of beneficial results; or the frozen extremity may be immersed in iced water, and light friction then applied, so as not to unnecessarily irritate the part. The temperature of the room must at first be low, and the greatest possible care is requisite not to permit the too sudden application of heat, nor even to allow the patient to approach a hot fire. According to Sir Astley Cooper, even the warmth of the bed, in these cases, frequently occasions inflammation, which is extremely liable to run into gangrene. He also confirms the observation of Larrey, that soldiers who have been exposed to severe cold, and have opportunities of warming themselves, suffer the most. When once the general temperature of the body approaches the normal standard, relief may be derived from the use of stimulating embrocations, such as spirit and water, soap-liniment, tincture of arnica, or camphorated spirit. Dr. Moore, of the United States Army, in cases of superficial frost-bite, applied lint saturated with fresh ox-gall, with great benefit. The parts may then be placed in a moderately elevated position, in a warm room, and covered with cotton-wool, or may, perhaps, be better exposed for a time to the warm air of the apartment. Warm drinks may now be given, with a moderate quantity of stimulant, if necessary. In the event of excessive local reaction, cooling lotions may be applied, and strict attention must be paid to the associated constitutional indications. Dr. Hayes[2] relates the following interesting case:—

An Esquimau had his leg frozen above the knee-joint, stiff, colorless, and, to all appearances, lifeless. He was placed in a snow-house, at a temperature of 20° below zero (Fahrenheit). The parts were bathed in ice-cold water for about two hours, and then enveloped in furs for three or four hours. Then frictions were used, first with the feathery side of a bird skin, then with snow, alternately wrapping the limb in furs and rubbing it, for nearly twenty-four hours. It was next carefully wrapped up, and the temperature of the snow-house raised by lamps above zero. On the third day, the patient was taken to his house (in the Esquimaux houses there is often a temperature of 70° or 80° F.), and in seventy hours was walking about, with only a slight frost-bite on one of his toes.

This case shows how much may be accomplished with care and perseverance, even under the most adverse circumstances.

It is a well-known fact that the whole surface of the body becomes less

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[1] Op. cit., t. iv. p. 134. Paris, 1817.   [2] Boston Medical Journal, vol. lvii. p. 48.

sensitive to the touch under the effect of excessive cold, and that the other senses participate, to a certain degree, in a partial reduction of the normal acuteness of nervous sensibility. When excessive cold has been applied to the body for a sufficient length of time to render recovery doubtful, still more care must be exercised in regard to the application of heat. Larrey says:[1]—

"Woe to the man benumbed with cold . . . if he entered suddenly into a too warm room, or came too near the great fire of a bivouac. The benumbed or frozen extremities . . . were struck with gangrene, which manifested itself at the very instant, and developed itself with such rapidity that its progress was perceptible to the eye. Or else, the individual was suddenly suffocated by a kind of turgescence, which appeared to seize upon the pulmonary and cerebral system; he perished as in asphyxia. Thus died the chief apothecary of the guard . . . Weakened by cold and abstinence, a refuge was offered him in a very warm room of the hospital pharmacy; scarcely had he passed a few hours in this warm atmosphere, which was new to him, when his limbs, which he no longer felt, became swollen and bloated, and he expired soon afterwards in the arms of his son and of one of his colleagues, without being able to utter a single word."

[In the treatment of persons apparently dead from cold, besides the frictions with snow or ice, or tincture of camphor, etc., practised in a cold room, artificial respiration should be employed and continuously persisted in, if necessary, for several hours. Life may be sometimes saved in this way under circumstances which at first appear to be perfectly hopeless. Tédenat[2] refers to a case treated by his father, in which the patient, a man seventy years old, had been buried in the snow for twenty-four hours, and yet escaped with superficial gangrene of the toes. The same author quotes from Pilhes the case of a blacksmith who was four days buried in snow, and from Reeve, the still more remarkable case of a woman who remained eight days buried in snow about six feet deep; both these persons were taken out alive, but perished afterwards from gangrene. Nicolaysen reports a case in which the patient recovered, though the temperature in the rectum had fallen to 76.4° Fahr.]

When, in spite of the treatment adopted, gangrene of the part follows, the application usually employed, in Canadian hospital practice, is a linseed-meal poultice, which facilitates the separation of the slough. As the dead part recedes from the living, a favorite dressing is carbolized oil, one to twenty. When once the lines of demarcation and separation are well and thoroughly defined, amputation may be performed. These cases are commonly attended with considerable debility, and require constitutional support by the free use of tonics and nourishing diet. Parts which have once been frozen are very liable to be again affected in the same manner, and hence more than ordinary care is necessary in such cases. Flannel is the great protective, combined with dryness of the parts, and a liberal supply of heat-producing articles of food. The question frequently arises as to whether alcoholic beverages lessen the disposition of the body to suffer from cold. The practical experience of every-day life demonstrates the contrary. Sir Garnet Wolesley, during his Northwest Expedition in the winter of 1870, avoided the use of spirits amongst his men, and, in consequence, not a single case of frost-bite was observed in the severe march from Thunder Bay to Winnipeg. Such, also, has been the experience of Arctic explorers; and, in Canada, it is well known that alcohol freely used during the winter season, tends to lessen the temperature of the body, and thus renders the individual more liable to the effects of cold. The carbon of alcohol is far inferior to that of good pork or bacon, as a heat-producing basis for supplying the normal requirements of the system, and thus fortifying it against the results of exposure.

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[1] Op. cit., t. iv. p. 134.   [2 Des Gelures, p. 54. Paris, 1880.]

ABSCESSES.

BY

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THE work of which this essay forms a part contains an article on Inflammation, in which the reader will find a description of the phenomena that precede the formation of pus. It will, therefore, here be enough to introduce only so much of pathology as bears directly on the study of abscess from a surgical point of view.

NATURE OF ABSCESS.

Although the term abscess is frequently used with considerable latitude, it may be simply yet strictly defined as a circumscribed collection of pus. This collection is sometimes inclosed in one of the small natural cavities of the body, as for instance in the antrum of the upper jaw; sometimes in the synovial cavities of the joints; or in bursæ. Sometimes its walls are formed by the sheath of a muscle, or by strong fasciæ, as in the case of a psoas or iliac abscess, or of one within the capsule of the parotid or the prostate gland. But more commonly the hollow in which the abscess lies has been formed by the destruction, or pushing aside, of the structures of the part in which it is imbedded. The cavity, however formed, if we take a typical instance, is lined with a more or less distinct sac or membrane, produced by the organization of the products of inflammation at the confines of the affected area. This membrane, termed "pyogenic," may frequently be clearly seen in chronic abscess of cancellous bone, or on the surface of the pleura in cases of chronic pleurisy, where it may be stripped off as a distinct layer of considerable thickness and toughness, presenting the appearance of granulation-tissue rich in bloodvessels. In the early stages of abscess, and generally in cases of acute suppuration, no distinct membrane is developed, and pus is circumscribed only by a wall of coagulable lymph, permeated by leucocytes, and blended with the tissues into which it is effused. When the tendency to coagulation, which is one of the characteristics of healthy lymph, is deficient, the extension of pus widely in all directions, but chiefly along the intermuscular and subcutaneous planes of the connective tissue, and along the sheaths of bloodvessels, takes place, and the process becomes one of "diffuse suppuration."

CHARACTERS AND PROPERTIES OF PUS.

Healthy, or laudable pus is a yellowish-white liquid of the consistence of thick cream, with a smooth unctuous feel when rubbed between the fingers,

a faintly salt taste, and, when first removed from the body, and still warm, a peculiar sickly and mawkish smell. Its reaction is alkaline, but it readily becomes acid in consequence (it is commonly supposed) of a slight lactic-acid fermentation. If left at rest after it is withdrawn, it gradually separates into its two primary constituents, pus corpuscles, which form a more or less abundant sediment, and a supernatant fluid portion, closely resembling liquor sanguinis, and often termed "liquor puris." Pus corpuscles are identical in their aspect with the white cells of the blood. After death they appear as semi-translucent, rounded, or irregularly shaped, and slightly flattened bodies, $\frac{1}{2500}$ to $\frac{1}{3000}$ inch in diameter, containing a number of dark granules, and one, two, or several obscure nuclei. When treated with acetic acid they become spherical, and are rendered transparent, so that their nuclei can be more clearly seen.

The *source from which pus corpuscles are derived* has been the subject of much speculation; but it now seems safe to affirm that they are for the most part neither more nor less than leucocytes, migrated from the blood current. Some, however, in all probability are developed by the multiplication of the cellular elements of the inflamed tissues. Pus corpuscles, in whichever manner produced, play a highly important part in the development of abscess. During the active, that is, the amœboid period of their existence, they have the capacity of travelling widely into the adjacent tissues.[1] They also manifest the power of surrounding concrete matter with their own substance. Thus "when a piece of fresh cellular tissue is inserted under the skin of a living animal, and allowed to remain there for several days, it becomes soaked with a liquid teeming with living amœboid leucocytes, all of which possess the ingestive faculty just referred to." "It has not as yet," Dr. Sanderson continues, "been experimentally demonstrated that leucocytes actually prey upon the nutritive constituents of the slough, but it certainly appears as if they determined its liquefaction;" and further on he says: "The existence in leucocytes of a power of absorbing tissues with which they are brought into contact, is probably the explanation of the destructive tendency which is so important a character of all intense inflammations," and which leads not only to the formation of an abscess cavity, but also to the softening and erosion of the tissues in the processes of burrowing and pointing to which allusion is made further on. But on the other hand, it is largely by the agency of leucocytes that the limiting membrane, or sac of an abscess (pyogenic membrane), is developed. In the confines of the affected area, where the inflammatory process has declined in severity, and become less acute than at the centre, an exudation of plastic lymph, or fibrinous material charged with leucocytes, occurs. In this material, fibrillation takes place, and large cell-elements (produced either by the continued growth, or perhaps by the union, of the smaller elements) make their appearance. Many of these throw out processes, and become branched; and, their branches uniting with those of neighboring cells, a more or less reticulated structure is produced. This becomes vascular, apparently by the canalization of the branched cells. This new tissue which, as its name (pyogenic) implies, was formerly credited with the actual production of pus, must still be allowed to be accessory to the increase of the abscess which it incloses, for, as Dr. Sanderson has pointed out, its recently formed and delicate vessels are well adapted by their number, structure, and arrangement, to favor the extrusion of leucocytes.

[1] Dr. Burdon-Sanderson, article on **Inflammation.** Holmes's System of Surgery, 2d edition, vol. v. p. 784.

Varieties of Pus.

Pus may differ in various respects from the healthy standard described above, and we accordingly find it in the text-books termed *sanious*, when it is mixed with blood; *ichorous*, when it is acrid and produces excoriations where it flows; *curdy*, or *flaky*, when it contains flakes and masses of loosely coagulated fibrine; and *serous*, when it is thin and watery. If it be thought worth while, these terms may, as they are unobjectionable and sometimes, perhaps, convenient, be still retained, but the conditions which they indicate are mainly accidental, and scarcely specific enough to require separate names. As to the microscopic appearances of unhealthy pus, Sir James Paget remarks: "When pus deviates from health we find not only variations in the pus cells, but multiform mixtures of withered cells, molecular and fatty matter, free or escaped nuclei, blood corpuscles, fragments of granular substance like shreds of fibrine, and other materials such as scales of cholesterine, crystals of triple phosphates, and free oil globules."[1]

Classification of Abscesses.

In attempting to classify the different kinds of abscess on a satisfactory basis, it seems advisable to make some change in respect to the terms hitherto in use; for such designations as lymphatic, congestive, and phlegmonous, cannot be said to convey any definite meaning, and the names metastatic and secondary are superfluous, since the abscesses they indicate are due either to pyæmia or septicæmia, and are better plainly termed after these conditions, pyæmic or septicæmic, as the case may be. Diffuse abscess is a phrase which involves something in the nature of a contradiction in terms, for abscess, by almost all authors alike, is defined as a circumscribed collection of pus; while to call an abscess emphysematous or tympanitic, is to encumber a general classification with matters of detail, which really belong to the chapter of accidental complications.

In the first place, abscesses may be broadly divided into the *acute* and the *chronic*—two groups which present strong contrasts, in respect not merely to their rates of progress, but to their symptoms and tendencies, the various dangers incidental to their course, and the treatment by which they should be met. Between these two extreme forms, however, there of course exist examples of every grade of difference.

Or, secondly, abscesses may be arranged according to the causes to which they are due. Such a classification, a very important one in reference alike to their pathology and treatment, would embrace—if we take, first, those which proceed from some general cause—(1) abscesses which result from some *defect of the patient's health*, such, for example, as may be induced by intemperance, hardship, or overwork, long residence in hot climates, or, in the case of females, pregnancy or too prolonged lactation; (2) those that are met with in the different forms of *blood-poisoning*—pyæmia or septicæmia (including that variety which occurs in the puerperal state); (3) those that are developed as the sequelæ of the *exanthemata*—typhoid or scarlet fever, smallpox, etc.; and (4) such as are *tuberculous* or *scrofulous*. Of the remainder, which arise from some local cause, there are (5) those following injury, and conveniently termed *traumatic*—such as form in the scalp, in the various joints, beneath the periosteum, in bursæ, and in the sheaths of tendons, etc.; and (6) abscesses pro-

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[1] Lectures on Surgical Pathology, 3d edition. London, 1870.

duced by some form of *local irritation*, as for example urinary or fecal extravasation, effusions of blood undergoing retrograde change, retained and acrid sebaceous material, or, in rare instances, by such parasites as hydatids, or, more rarely still, in ordinary practice, by the filaria medinensis; or by lumbrici escaped from the intestine and lodged in the abdominal wall; by calculi, whether in the tonsil, the ducts of other salivary glands, or in the kidney or prostate; by necrosed fangs of teeth, or by portions of bone quietly exfoliated after injury; or by foreign bodies—such as fragments of wood, etc.—whose accidental introduction beneath the surface has perhaps been overlooked. The foregoing list will suffice to show on what a variety of local causes suppuration may depend, and will at the same time direct attention to the necessity of ascertaining the circumstances under which abscess has occurred, before deciding how it may be appropriately treated.

Under the title of "Residual Abscess," Sir James Paget[1] has described "abscesses formed in or about the residues of former inflammations." "Most of them," the author writes, "are formed when pus, produced long previously, has been wholly or in part retained, and become dry or in some form obsolete." But some of them, it is probable, are formed "in the thickenings and adhesions, and other lowly organized products of inflammations long past."

Several illustrative cases are given in the paper referred to, among which was that of a woman of 30, admitted into St. Bartholomew's Hospital in good general health, with a circumscribed swelling over the sacro-iliac symphysis, painless and elastic. It was thought to be a fatty tumor, but the operation begun (by Mr. Stanley) for its removal let out pus from a cavity leading, by a narrow track, to the hip-joint. Disease of this joint had existed twenty years previously, and had subsided without apparent suppuration, after a year's rest. The patient had remained lame with stiffness of the joint, but with no other distress, and the abscess had not been observed for more than two years before it was opened.

Another case was that of a woman, aged 38, in whom an abscess formed in the head of the tibia twenty-eight years after some necrosis of the bone, the limb having in the interval been apparently quite sound.

A patient has lately been under treatment at St. Bartholomew's Hospital, who sustained a compound fracture of his humerus twenty-five years ago at the battle of Balaklava. The fracture had united favorably, and the soft parts had healed in the course of about three months; and for nearly twenty-four years the patient had been constantly at work, and had thought the limb sound. Two months before his admission, the arm, at the seat of injury, had become swollen and very painful. A large abscess formed, and was evacuated by incision. It quickly healed, and within two months the patient was able to return to his work.

The side of the rectum, Sir James Paget remarks, is a locality in which hardnesses marking the sites of former inflammation threatening or producing abscesses, are nearly sure to suppurate, though many years of apparent quietude may have elapsed; and he gives one case in which fourteen years, and another in which ten years, passed between the time of healing of an abscess in this situation and that at which a renewal of suppuration in the residues of scar and unsound tissue, which it had left, ensued.[2] Yet these cases are not always thus favorable. The amount of obsolete material to be discharged, including bone-detritus, may be so large that the patient's strength is dangerously taxed by pain, and by copious and prolonged suppuration.

A young lady was recently under the care of Sir James Paget, with a residual abscess following, after a long interval, on disease of the spine. Suppuration was profuse, and

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[1] Clinical Lectures and Essays, 2d edition, p. 309. London, 1879.
[2] [The editor has under observation a case in which two such renewals of suppuration have, in the course of years, ensued in the site of an old, cured fistula-in-ano, the "residual abscess" in each instance healing within a few days after the evacuation of its contents.]

considerable quantities of fragments of bone coated with large crystals of lime-salts continued for many months to be discharged, and the patient nearly died of exhaustion. At length, however, the effete material seemed to have been expelled, the sinuses healed, and the patient was restored to health.

In studying the clinical aspect of residual abscesses, it should be borne in mind that, as a rule, their appearance does not indicate a renewal of the original disease, nor do they generally affect the integrity of the repair which has taken place. Suppuration, indeed, seems to involve only such products as have become effete, and not to reach those which have been fully organized into new tissue. Hence, even when they originate in the immediate vicinity of the spine, or one of the large joints, they frequently run the course of common chronic abscesses; and like these they may be treated. After evacuation, they often heal quickly and very favorably, without fever, or any serious complication.

Symptoms of Abscess.

When in the course of the inflammatory process suppuration occurs, and abscess is formed, the event is marked by the following symptoms. Of these, however, it must be premised that they vary very much in different cases: the difference depending, perhaps mainly on the speed with which pus forms, and on the structure of the part in which it is collecting. The more acute the abscess, and the greater the tension to which it leads, the more pronounced will the symptoms be; while in abscesses of a chronic character, all the usual symptoms, except swelling, may be so completely absent that the affection is not unfrequently mistaken for a fatty or some other form of tumor.

PAIN.—The degree in which this symptom is present varies extremely in different cases. In some instances, pain is greatly aggravated when the formation of pus takes place, chiefly by the increase of tension which it produces. This is the case in abscesses formed beneath unyielding structures—for example in the sheaths of tendons, in glands with dense capsules, or beneath strong fasciæ, as in the neck, or the perineum—and in those inclosed by bone, such as alveolar abscess, or abscess in the articular ends of the long bones. In all these instances the patient's suffering increases hour by hour till matter is let out. On the other hand, in tissues that readily yield, the formation of pus is followed by the rapid subsidence of inflammation, matter travels unimpeded towards the surface, tension grows less, and, while tenderness increases, pain is considerably diminished.

RIGORS.—Though these are occasionally met with in cases of deeply seated suppuration, attended with marked constitutional disturbance, and also in cases of suppuration in the neighborhood of the urethra, they can scarcely be included in the list of the common symptoms of acute abscess. They are often of much graver import, and indicate the existence of some form of blood poisoning.[1]

LOCAL SYMPTOMS.—The local signs of abscess are fluctuation; œdema, with pitting under pressure; a soft spot, surrounded by brawny œdema; a tender spot.

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[1] In those who have had ague, suppuration may provoke its return, and the rigors attending this affection may suggest fears, which afterward happily prove groundless, that the patient has pyæmia.

Fluctuation.—In any situation where the presence of matter is suspected, the fingers of either hand are placed on the surface at different points, and pressure is made alternately with the right hand and with the left, in order to ascertain whether a wave of fluid can be felt passing from one hand to the other with perceptible bulk and elasticity; or, in other words, whether there is a collection of fluid which can be displaced with the fingers of the right hand, and be made to rise as an elastic swelling beneath the fingers of the left, and *vice versâ*. The manner of using this test varies in different cases. In small superficial abscesses, only one finger of each hand is employed, and these are placed only half an inch apart, and very light pressure is used. While in large abscesses deeply placed, as for instance under the glutei, or among the muscles of the thigh or calf, several or all the fingers should be placed flat on the surface, and be kept applied with some degree of firmness while each is used alternately with the other to produce an interchange of pressure and partial relaxation. Abscesses in which fluctuation is most distinct, are those which are large and near the surface, and covered only by thin and pliant soft parts—a typical instance being that form of chronic abscess which is so often seen in connection with disease of the spine or hip-joint. It is very distinct also in even small abscesses, if they are quite superficial. But, on the contrary, where the collection is small, and at the same time deeply placed, no fluctuation can be obtained, especially where the superficial parts are firm and brawny, and where parts forming the background of the abscess—the parts, in other words, on which it rests—are soft and yielding. This is the case in many abscesses in the ischio-rectal region. Here fluctuation is obscured not only by tough and brawny skin, and a thick layer of firm subcutaneous fat, but also by the yielding nature of the structures forming the side of the bowel with which it is in contact, and which, instead of opposing a firm base against which the abscess may be held while it is pressed to and fro with a wave-like motion, through the interval between the fingers, allows it to recede and thus elude manipulation. Again, in the armpit, where matter lies beneath the strong axillary fascia, and rests on the fat and loose cellular tissue in the deeper part of this space, no fluctuation can be detected even though the collection of pus be considerable.

Thus, although fluctuation is a highly characteristic symptom of abscess when it is present, there are many cases in which, though matter has formed, no fluctuation can be obtained. It is the more important to bear this in mind, because the cases in which it is difficult or impossible to detect fluctuation are precisely those in which it is most necessary to evacuate pus as soon as it has collected—as, for instance, in abscess by the side of the neck, in the armpit, in the popliteal space, in the deep part of the mammary gland, in the perineum, by the side of the bowel, etc.

Œdema with Pitting on Pressure.—In a case of acute inflammatory swelling, if the finger is placed on the most prominent part of the surface, or where the skin is ruddy or dusky, and pressure is maintained for a few seconds—and if, when the finger is removed, it is seen to have left an impress in the form of a distinct though shallow and flattened pit, with a sharp, clearly-defined border—here is very strong evidence that suppuration has occurred. This proceeding, though it may give much pain if the extreme end of the finger is suddenly and heavily thrust down on the swelling, especially if the nail be allowed to touch the part, may be rendered quite painless if the flexor aspect of the finger be used, and if care be taken that pressure, light at first, is only gently and moderately increased. The value of this symptom of " pitting on pressure" is sometimes overlooked, yet it may often be depended upon to disclose the presence of pus when no other evidence of its formation can be obtained.

If the finger be passed over the inflamed part, a *soft spot surrounded by brawny induration*, and with a clearly-defined edge, may often be detected. This spot may be round or oval, and so small as to escape any but the most careful search, or it may be an irregular patch of some considerable extent, abruptly bounded by a distinct firm border. It marks the site at which matter that was at first deeply placed has come to the surface, and is shut in merely by skin and softening subcutaneous tissue. Again, though no softening can be detected, some spot may be so *exquisitely tender* that the patient shrinks and complains of sharp lancinating pain whenever even slight pressure is made over it. Here (at the tender spot), as in the former case, matter is on its way to the surface, and the tenderness on pressure is due to the increased tension of the abscess-cavity. Very often the spot which is tender is at the same time soft also; and the existence of softening and tenderness at the same spot is still stronger evidence that matter is beneath, and at no great distance from the surface.

POINTING OF ABSCESSES.—As matter forms and increases in quantity, it shows a tendency to travel in the direction in which it meets with least resistance; and thus, although at very different rates of progress in different cases, it makes its way towards the surface, or, more rarely, towards one of the mucous or serous cavities of the body. This process seems to be in part merely mechanical, and to result from the pressure which the accumulating pus exerts on the surrounding structures; but it is also largely due to the liquefaction and absorption of the tissues by the leucocytes by which they are permeated. On approaching the surface, the abscess is said to "point," that is, it forms a more or less circumscribed and more or less prominent, sometimes nipple-shaped, swelling, soft in the centre. The skin over this swelling, in cases of acute suppuration, now becomes red or dusky, smooth, and glazed, while the surrounding parts are firm, brawny, and œdematous. In the case of chronic abscesses, the process of pointing is so gradual that the skin softens and grows thin and dusky without any wide or active disturbance of its nutrition. Should no interference with the natural process take place, when pointing is complete, the skin bursts, and the abscess-cavity discharges its contents.

CONSTITUTIONAL SYMPTOMS. — The general symptoms of abscess scarcely admit of description apart from those attending the earlier stages of local inflammation; and it will be sufficient to remark that while, like those observed in the preceding periods of the inflammatory process, they are often unimportant, in some instances they are so severe as to afford grave reasons for the evacuation of pus at the earliest practicable moment. The pulse is small, compressible, and rapid; the temperature high, reaching 103° or 104° Fahr.; and there are frequent rigors, copious sweating, complete loss of appetite and of sleep, rapid wasting, and extreme nervous depression with a tendency to syncope. When these symptoms are present, in abscess of one of the large joints, the testis, or the prostate, or beneath the firm structures of the hand or elsewhere, immediate evacuation must be resorted to.

DIAGNOSIS OF ABSCESS.

Abscess is one of the most common of all surgical disorders. All have often met with it, and there are few who have not had some personal experience of its features, its stages, and its treatment. And yet there are no affections more difficult to diagnose than are some of the forms of abscess, and

none in which the incautious practitioner has been more often led into serious and embarrassing mistakes. It is true that the characters of acute abscess are usually unequivocal, though even here error has not always been escaped. But it is in the case of subacute or chronic abscesses that diagnosis has most often been at fault. Setting aside such mistakes as care and common knowledge should teach us to avoid, it may be useful to review the causes which may render diagnosis difficult.

The symptoms of abscess in a typical case are (1) those of local inflammation—vascular disturbance, swelling, redness, heat, pain, tenderness; (2) those which denote that inflammation has resulted in suppuration—fluctuation, pointing, œdema, and others referred to above. In many abscesses, however, not only are these symptoms, with the exception of swelling, entirely absent, but they are replaced by others apparently suggestive of some other and altogether different affection.

Thus if an abscess, holding two or three ounces of pus, have slowly formed, whether from the patient's broken health, or, for instance, in connection with obsolete spinal or joint disease, it may be completely free from heat, pain, and tenderness. As time goes on—and such an abscess may remain almost unchanged for many months, or even sometimes for years—the limiting (pyogenic) membrane grows tough and firm, and when, as pus gradually accumulates, the sac becomes full and tense, a circumscribed, rounded or oval, and more or less movable, swelling is produced, in which, if it rests on soft and yielding structures, and is covered by a thick layer of subcutaneous fat, no fluctuation can be detected. Here the likeness to a *fatty* or *fibro-cellular tumor* is so complete that the real nature of the swelling can only be determined by an exploratory puncture. Again: a large, slowly-increasing swelling is found in some such situation as the temporal fossa, the adductor region of the thigh, or deep in the muscles of the calf. It is diffused, and firm or obscurely elastic, without perceptible fluctuation, with no heat, pain, or tenderness, and is covered with skin that is smooth, tense, faintly dusky, and marked with distended veins. These symptoms may well give rise to a strong suspicion that *malignant disease* is present. Under such circumstances many have fallen into serious errors, of which the following may be related as examples:—

A gentleman, finding a swelling deep in his groin, showed it to his medical attendant, who was doubtful of its character, and wished for a consultation. This took place, and the opinion was formed that the disease was malignant, and likely to pass on to a rapidly fatal end. As a few weeks' observation seemed to confirm this prospect, the patient accepted the verdict, and prepared for the result. He disposed of the lucrative business in which he was engaged, funded his capital, appointed executors, and withdrew into the country. Scarcely were all these arrangements completed when an abscess pointed in the groin. This soon burst and discharged about fifteen ounces of pus. He now regained his health and strength. His business, however, much to his chagrin, had passed beyond reach into other hands.

Many years since, a mammary gland was amputated at one of the large London hospitals under the belief that it was the seat of carcinoma. When the breast was subsequently examined, it was found to contain, not a scirrhous tumor, but a thick-walled chronic abscess.

In a case known to the writer, a child was pronounced, by a high authority in surgery, to have malignant disease in the temporal region; but the event proved the case to be one of abscess deeply seated beneath the temporal aponeurosis.

In the surgery of childhood, the writer has also on several occasions seen deep-seated abscesses about the shoulder, in the thigh, the abdominal wall, and the cellular tissue of the pelvis, mistaken for malignant disease. Conversely, malignant disease may sometimes very closely resemble chronic abscess.

A patient was believed to be suffering with abscess in the liver, and, a few weeks later, the discovery of a soft, elastic, and prominent swelling, covered with thin and dusky skin, seemed to confirm the view. When the tumor was punctured, however, only blood escaped, and the disease proved at length to be carcinoma.

The writer has twice seen malignant disease of the kidney, in children, punctured through the loin, in the belief that the swelling, which was soft, highly elastic, and apparently fluctuating, depended upon abscess. He also remembers the following case:—

A boy, aged 10, was admitted into a hospital with what was regarded as some form of new growth in process of ossification, in the superior maxillary bone. There was considerable enlargement, with bulging both of the hard palate and the anterior wall of the bone. The affection had been in progress for almost four months, and was now, and throughout its course had been, almost completely free from pain and tenderness. In the belief that the disease was malignant, the usual incisions through the middle line of the lip, and by the side of the nose, were made, for the removal of the upper jaw. A colleague of the operator entering at this moment suggested an exploratory puncture, and, when this was made, a collection of thick and curdy pus was found occupying the much-enlarged, but still firm-walled, cavity of the antrum.

The diagnosis between abscess and *aneurism* may sometimes be difficult. When suppuration has occurred, whether in lymphatic glands or otherwise, in such situations as the side of the neck or the groin, and when the surrounding tissues are either brawny, or matted and adherent, each pulsation of the neighboring large bloodvessel may be very distinctly communicated to the abscess. In any case of doubt, diagnosis will mainly turn on (1) the character of the pulsation, whether it is expansile and centrifugal, or merely a jerking, or lifting of the tumor without alteration of its size; (2) whether pulsation can be felt in all parts of the tumor; (3) whether by gently pushing the tumor this way or that, its relation to the artery is so far altered that its pulsation is materially diminished; and (4) whether when the vessel is compressed on the proximal side, the tumor becomes materially smaller, while when pressure is removed it enlarges again with a heaving, expansile wave. The age of the patient, the presence or absence of bruit, the condition of the arterial system as to degeneration, the existence of constitutional syphilis, the history of the case as to injury, etc.—these and similar matters all deserve consideration, though they must not be allowed too much weight. For though aneurism is, as a rule, met with only in adult life, many examples in young persons have been recorded; bruit is often absent even in well-marked aneurism; while the patient's history and other points referred to are often not a little likely to mislead. Not only, however, is there some danger of mistaking aneurism for abscess and abscess for aneurism, but, it must be remembered that the two affections may exist together. Cases are sometimes met with in which, as in the examples mentioned below, an abscess makes its way into the trunk of a large bloodvessel. Should such an event occur, it will usually be declared by the following symptoms. The abscess-swelling undergoes a sudden and considerable increase of size, becomes tense and painful, and is found to pulsate. The amount of pulsation has been observed to differ very much in different cases. In some it has been extensive, forcible, and distinctly expansile; in others it has been faint, or scarcely perceptible; in some, again, and these must be carefully borne in mind, pulsation has been entirely absent.

COMPLICATIONS OF ABSCESSES.

It is not necessary here to discuss all the dangers and drawbacks that may be encountered during the progress of abscess. The occurrence of putrefac-

tion, extensive burrowing, sloughing of tendons, the formation of adhesions and of disfiguring scars—these and other results will be alluded to in the section relating to treatment. But there are other complications which may claim attention under the present heading.

HEMORRHAGE.—Although vessels in the neighborhood of an abscess are often obliterated by plugging, so that hemorrhage is guarded against, this provision may fail, and, as the abscess enlarges, a principal artery or vein may be opened.

In the case of a man aged 37, three days after a large abscess in the side of the neck had been opened, so profuse a hemorrhage suddenly occurred that the patient fell back in bed, and seemed to have expired. Bleeding ceased for a time, but soon recurred, and an attempt was made to secure the vessel that had given way, and which was believed to be one of the divisions of the common carotid. The attempt, however, failed, as the perforation was situated out of reach, near the base of the skull. The common carotid was therefore tied, and the wound was firmly plugged; but the patient rapidly sank. On examination, it was found that the abscess-cavity was in a sloughing condition, and that a large perforation had occurred in the wall of the internal carotid, close to the base of the skull.

A man aged 23, while resting quietly in bed with caries of the lumbar spine and a large psoas abscess, was suddenly attacked with the symptoms of internal hemorrhage; he became pale and restless, and sweated profusely, and his pulse was rapid and scarcely perceptible. It was observed also that the abscess in the sheath of the psoas had much increased in size and had become painful, and was much firmer and more tense than it had previously been. He died in the course of thirty hours. Post-mortem examination showed that the abscess had extended into the aorta, in the side of which there was an opening nearly a quarter of an inch in diameter. The cavity of the abscess was distended with a large quantity of blood mixed with the pus it had previously contained.

A still more remarkable instance of this formidable accident may be briefly related. A patient was admitted into St. Bartholomew's Hospital, in whom an alarming hemorrhage had suddenly taken place from some sinuses connected with a small glandular abscess in the groin, following gonorrhœa. On examination, after death, which occurred from exhaustion, it was found that both the femoral artery and vein had been laid open by ulceration connected with the abscess-cavity.

Two cases have lately been met with, in one of which the gluteal artery was opened by ulceration extending into it from an abscess travelling outward through the sacro-sciatic foramen, and another in which the internal pudic was perforated by an abscess in the ischio-rectal fossa.

In the Museum of St. Bartholomew's Hospital is a specimen showing perforation of the arch of the aorta, in a boy aged 8 years, by an abscess formed in the anterior mediastinum.

If a large chronic abscess, on the first occasion of interference, be completely evacuated, either by the aspirator or by incision, the vessels of its walls, suddenly deprived of their accustomed support, may become turgid, and free oozing into the cavity may result. This may be a troublesome occurrence when the abscess is so placed that efficient pressure cannot be employed, and if the patient be already much exhausted. In a boy aged 9, with advanced hip-disease, bleeding into the cavity of an abscess in front of the thigh, opened by incision, proved very persistent, and could only be arrested by the injection of a strong solution of perchloride of iron. Similar oozing is occasionally met with after the opening of large abscesses in the neighborhood of the abdomen, as, for instance, in the iliac fossa.

COMMUNICATION WITH INTERNAL CAVITIES. — Abscesses sometimes make their way into the mucous or serous cavities of the body. Instances in

which the *urethra* and *rectum* are thus involved, are treated of in the articles devoted to diseases of those regions. Should an abscess burst into the *œsophagus*, no serious mischief need usually be anticipated. Retro-pharyngeal collections of matter, arising from disease of the spine, or whatever other cause, may burst, discharge, and heal without serious trouble. The discharge of an abscess into the *peritoneal cavity*, as, for instance, in suppuration around the appendix vermiformis, is quickly followed by acute peritonitis. In these cases the symptoms may bear so strong a likeness to those of acute intestinal obstruction, that an error of diagnosis is very likely to occur.

A man aged 55 was attacked, while walking in the street, with sudden and severe pain in the umbilical region, vomiting, and a sensation as if " something had slipped down" within his abdomen. From this date he continued in severe pain, and was frequently sick ; the abdomen became tympanitic, and the appearance of obstruction was so complete that not even flatus was passed from the rectum. No local tenderness could be detected. The case was thought to be one of intestinal obstruction, and colotomy was performed in the right loin. Examination after death disclosed acute peritonitis following perforation of the vermiform appendix.

The *urinary bladder* is sometimes invaded.

A woman aged 34 was under treatment for a large tumor, believed to be uterine hæmatocele, between the bladder and vagina. Three weeks before death she was suddenly attacked with rigors and very severe pain, and her temperature rose to 104° Fahr. ; four days later the symptoms of acute cystitis appeared, and she passed several ounces of fetid pus mixed with blood from the bladder. After her death it was found that suppuration had occurred around the blood-collection, and that the abscess had burst into the bladder.

The writer has seen two cases in which, in the course of hip-disease in children, with perforation of the acetabulum, an abscess, formed within the pelvis, burst into the *rectum*. Feces subsequently passed freely through the cavity of the abscess and through the hip-joint, and were discharged on the surface behind the trochanter. Both cases ended fatally. Abscesses occasionally burst into the *joints*. Thus, in psoas abscess, matter may pass into the bursa lying between the psoas tendon and the capsular ligament of the hip, and thence into the cavity of the joint with which the bursa often freely communicates ; and, in abscess of the popliteal space, pus is apt to enter the knee-joint through spaces in the ligament of Winslow. In children, there is danger that if abscess, whether acute or chronic, form in the epiphyseal end of any of the long bones, it may perforate the articular lamella and the cartilage, and enter the neighboring joint. Of this accident, which is of somewhat frequent occurrence, the following case is an example :—

A child aged 5, who had a small chronic sinus at the lower end of the tibia, was attacked with sudden and such violent inflammation of the ankle-joint, that three days later it was found necessary to resort to a Syme's amputation of the foot. During the operation, when the joint was opened, a ragged hole was seen in the cartilage covering the tibia, and through this a small sequestrum dropped out of an abscess-cavity in the epiphysis of this bone.

Chronic abscesses in the neighborhood of joints may have an unsuspected connection with them, the explanation usually being that they have formed either in a bursa communicating with the synovial cavity, or in a pouch of the synovial membrane itself, which has been shut off by adhesions from the general cavity, and has afterwards been distended, so as to form an apparently independent collection.

In a boy, aged 18, suppuration of the knee-joint, necessitating amputation, followed puncture of a chronic abscess in the upper third of the calf. In two cases, acute inflam-

mation in the knee followed the opening of an abscess in the front of the lower third of the thigh. In none of these instances had disease of the joint been previously suspected.

TREATMENT OF ABSCESSES.

It may be laid down as a general rule that pus is to be removed as soon as it has formed. In cases of *acute abscess*, this rule may be considered very nearly absolute. We have now at our disposal the means by which the serious complications that were formerly met with as the result of putrefactive changes may be avoided, and the withdrawal of pus has a very beneficial effect in abating the severity of acute inflammatory processes.

There are indeed many occasions on which the surgeon must use every expedient to detect matter at the earliest moment of its formation, in order that it may be evacuated without delay. This practice must be strictly followed in abscesses beneath strong fasciæ, especially when joints, tendons and their sheaths, large bloodvessels, or other important structures are near at hand, or when pus is likely to burrow widely. Thus, in the ham, for example, if matter is allowed to collect beneath the expansion of the fascia lata by which this space is inclosed, it may find its way into the knee-joint, or lead to the destruction of the periosteum, and consequent necrosis, of the femur; or it may track its way widely upwards into the thigh and downwards into the calf. Similarly, in the neck, pus, if it be not at once let out, may travel into the anterior mediastinum, or the armpit; or may possibly even lead to perforation of the carotid artery or the jugular vein; or may burrow widely between the muscular planes, or in the course of the deep vessels. The same practice of removing matter early is called for, also, when suppuration occurs in the neighborhood of the rectum or urethra, in the mammary gland, and in glands with firm capsules, as the parotid, the prostate, and the testis; or when the nutrition of bone is threatened, as in suppuration beneath the pericranium, or beneath the periosteum of the long bones. Especially is this the case in the form of suppuration termed subperiosteal abscess, or diffuse periostitis, in which, in children, the whole periosteum may be detached from the shaft of a bone in the course of some twenty-four or thirty-six hours. In these, and in a number of other like instances, the whole course of the case turns on the early detection and evacuation of any matter that has formed.

The question whether *chronic abscesses* are to be opened, is one which does not admit of a simple answer, either for or against the practice; for chronic abscesses form under very different conditions in different cases, and, in deciding upon their treatment, these conditions have to be taken into account. If an abscess be of the kind termed spontaneous, that is unconnected with disease of the spine, the large joints, the kidney, or other parts of similar importance, it may, with due precautions, be evacuated at once. But if it results from such diseases as those just mentioned: if, for example, it has followed disease of the spine, there exists much difference of opinion as to the treatment that should be pursued. Many authorities leave the abscess to point and discharge itself, on the ground that while serious complications have often followed active interference, they are rarely seen when abscesses are left to spontaneous evacuation. The latter observation no doubt is true. But, on the other hand, let us remember that it is one of the characteristics of these abscesses that, though they may steadily increase in size, they show but little tendency to point, and that to leave them is to consign the patient to a long period of irksome delay, and also, it may be added, to expose him to the possible occurrence of some of the accidents that will presently be mentioned. As to the danger incurred by active interference, although the results of opening large

abscesses used often to be serious, the same ratio of improvement which has been secured in so many other departments of practice may be claimed in the present instance, and the experience of recent years seems to warrant the belief that the means are now within our reach by which former sources of danger may to a great extent be set aside. While, however, interference is generally advisable, the time for resorting to it must be very carefully chosen. The risk of complications in a case of psoas abscess, for instance, turns largely on the character of the spinal disease with which it is connected. If abscess makes its appearance while the spinal disease is still acute, and accompanied by pain, rise of temperature, wasting, or increasing deformity, evacuation should generally be postponed, and the patient be kept at absolute rest, until the more acute symptoms have subsided. But when it occurs late in a case of chronic disease, or when the patient has been long recumbent, and all acute symptoms have passed away—when, that is to say, vascular disturbance has subsided in the surrounding parts, and the wall of the abscess has become consolidated and firm—the danger of interference is comparatively small.

Acute abscesses are best evacuated by *direct incision*. It is important, both for safety's sake and also to secure ready drainage, that the opening be made where matter lies nearest to the surface. This may be ascertained either by observing where fluctuation is most distinct, or where pointing is most evident; or, where these signs are wanting—and it has been explained above that this will often be the case—by searching for the "soft spot" or the "tender spot," or the spot on the surface which most easily "pits on pressure." The precise pattern of the knife to be employed, though often much insisted on, is not very material, provided that it be sharp-pointed, keen-edged, and narrow, and tapered in the blade, so that it may enter with the smallest possible resistance. A knife, like a razor, cuts better if it be first immersed in hot water. The method that causes least pain is to pass the knife in at nearly a right angle to the surface, with a light and rapid movement, and to enlarge the puncture by withdrawing the blade, held obliquely, so as to divide the tissues with a light sweep from within outwards. When abscess is deeply placed, or is in the neighborhood of important structures, as in the neck, armpit, groin, or popliteal space, Hilton's method should be used. An incision is made through the skin and fascia, and a director is gently thrust through the intervening parts till matter is reached, and is seen to well-up along the groove in the director. Narrow-bladed dressing forceps are then passed by the side of the director into the abscess cavity, the director is removed, and the blades of the forceps are separated as they are withdrawn, so as to provide a sufficiently free opening. When abscess has formed beneath a healthy muscle, as, for instance, when suppuration occurs in the bursa between the gluteus maximus and the great trochanter, the incision made through the muscular substance for the evacuation of pus is apt to heal so that free discharge is interfered with. To prevent this, some form of drainage tube must be inserted, and kept in use till the abscess cavity has closed. Unless this precaution is taken, extensive burrowing is likely to ensue.

The *aspirator* of Dieulafoy may be turned to excellent account in the management of abscess. But there are certain points respecting it which should be borne in mind. In its best, that is, its simplest form, the instrument consists of a glass bottle, to act as a receiver, fitted with an india-rubber cork. Through this cork there is passed, so as to enter the bottle for about an inch, a metallic tube, the external part of which ends in two branches, furnished with stopcocks. To one of these branches an exhausting syringe is connected by means of a short piece of india-rubber tubing. To the other, a hollow needle—also mounted on india-rubber tubing—is adapted. A tubular needle, sharp by being cut obliquely at the point, somewhat like a quill-pen, may

generally be safely used, and is simpler and more convenient than a trocar and canula. The instrument is prepared for use simply by fixing on the two tubes, and exhausting the receiver. After exhaustion, it is rendered more portable by detaching the syringe and corresponding tube. It then consists merely of a tubular needle connected with an air-tight receiver. It is useful to interrupt the tube near the needle by inserting about an inch of glass tubing, so that it may be at once seen what kind of fluid is being drawn off. The tube leading from the needle to the receiver, and the passage through the stopcocks, must be of ample size—somewhat larger, that is, than the largest needle with which the aspirator is fitted—so that whatever can traverse the needle may also pass easily along the remainder of the route to the receiver. It is best, as a rule, to limit the use of the aspirator to abscesses which are large and not far from the surface. Those that are small are best treated by incision, while in the case of deep abscesses it may be dangerous to thrust the needle through any considerable thickness of soft parts, and difficult to know when the cavity has been fairly entered. The abscesses for which the aspirator is most suitable are those large collections which form in the course of disease of the spine or hip-joint, the large lax-walled kind that are met with in pyæmia, and the simple chronic abscesses which occur in persons of broken health. The result of aspiration will depend on the circumstances under which matter has formed. If suppuration is connected with still active bone or joint disease, it will persist, and the abscess will continue to refill till the primary disease has subsided. But if the abscess be residual, or if it be unconnected with any abiding source of suppuration, a single evacuation, or evacuation once or twice repeated, will be sufficient for its cure. Of this favorable result the writer has seen several instances, both in large psoas and iliac abscesses formed during the repair of spinal disease, and in abscesses about the hip in old disease of that joint. Pus is no doubt sometimes too thick or too flaky to pass through the needle, but this difficulty will not be of frequent occurrence if a short and fairly large needle be employed.

The scheme of *washing out* or *irrigating* abscesses at the time they are opened with some antiseptic solution, by which the degenerated products of inflammation may be at once removed, seems in theory a sound one, and, where putrefaction has occurred, some such proceeding should, whenever it is practicable, be adopted. Both the success and the safety of this practice will, however, be found to depend largely not only on the situation, but also on the form of the abscess in which it is employed. In simple chronic abscesses of limited extent, and with a distinct sac, it will often check suppuration and be followed by rapid healing, while in abscesses connected with joint or bone disease, especially if the disease is acute, if the abscess is large, and its sac thin and yielding, and if it is so placed that drainage is difficult, this treatment is apt to do much mischief by carrying the products of inflammation into localities that were previously free from them, and also by the disturbance of parts, by which, unless much care is used, it is attended. The plan of *hyperdistension* recommended by Mr. Callender, which consists in the forcible injection of carbolic lotion into the abscess cavity—so that its sac is tensely filled, and the lotion brought into contact with all its internal surface—and the repetition of the injection till the fluid returns unmixed with pus, sometimes proves very useful; but in several instances known to the writer, the proceeding, when employed in the form of abscess last alluded to, has been followed by acute suppuration and considerable fever.

Lister's method of treating abscesses, which consists of free opening by direct incision under the carbolic spray, and subsequent free drainage by the insertion of drainage tubes, together with the use of carbolic gauze for dressing, may be strongly recommended both for its convenience and its safety.

But as with the aspirator, and as with hyperdistension, so with this plan. Although pus may be satisfactorily removed, it will continue to accumulate whenever, and as long as, active bone or joint disease is present, as a source of suppuration. The results claimed for this method—the immediate healing of large abscesses, without re-accumulation of pus—are, as a rule, to be met with only in simple chronic, or in residual abscesses.

Abscesses in the neck, or in any other situation in which it is important to avoid a scar, should be opened before, in the process of pointing, they have led to softening and undermining of the subcutaneous tissue, and to impaired nutrition of the skin. If interference is long delayed, for example, in suppuration of glands, the destruction of subcutaneous tissue and skin which results will lead to the formation of a depressed, irregular, and adherent scar; while if evacuation is effected through still undamaged skin and subcutaneous tissue, the scar will be linear, and scarcely visible. To secure drainage, it is advisable to insert, for a few days, a narrow strip of gutta-percha tissue, into the cavity from which pus has been removed. Small abscesses are conveniently opened with a narrow-bladed tendon knife, introduced where pus is nearest to the surface, while, for those that are more deeply seated, Hilton's method should be employed.

SINUS AND FISTULA.

When suppuration has occurred, the evacuation of matter, whether spontaneously or by surgical interference, is, under favorable conditions, followed by the sound healing of the passage through which the pus has escaped. Under a variety of circumstances, however, this sound healing is delayed or prevented, and, although the opening may contract to very small dimensions, it does not completely close, but remains as a narrow, and often long and tortuous, canal, sometimes perhaps giving exit to very little secretion, or even seeming to be healed; at other times re-opening and discharging either healthy pus, or thin sero-purulent or watery fluid, mingled it may be with a little blood. Any such persistent passage leading from the surface into the soft parts is termed a *sinus*. For examples of sinuses may be mentioned, as the most common, those formed in the groin or neck after suppuration in lymphatic glands, or those that lead from the surface of a stump, after amputation, to unsound bone or periosteum, or into the substance of a breast, or into that of a strumous testis. A *fistula* is an abnormal passage, leading towards, or communicating with, one of the mucous canals or cavities of the body, or running between two adjacent mucous cavities. Fistulæ may be *congenital* (*e. g.* branchial; and umbilical, when either the urachus, or the ductus vitello-intestinalis remains patent at the umbilicus); or they may follow mechanical *injury* or *wounds* (salivary, intestinal); or be left after *sloughing* (vesico-vaginal); or after *ulceration* (as in malignant disease between the rectum and the bladder). In many of the varieties of fistula there is a direct continuity of skin and mucous membrane, or of two mucous membranes, lining the canals between which the opening is situated, while in others, the communication consists of a canal of more or less length lined with unhealthy granulations.

The descriptions just given apply to the terms sinus and fistula when they are defined with the purpose of maintaining a clear difference between them. It is customary, however, in practice, not only in the instance of incomplete fistula in ano, but on many other occasions, to use the word fistula as if it were synonymous with sinus, as when we speak of fistulæ, or fistulous passages, leading to dead bone, or towards a diseased joint. As "fistula" strictly

defined (recto-vesical, salivary, etc.) will be considered elsewhere, the following remarks will have reference chiefly to "sinus," and to those examples of fistula which are really only sinuses under another name, and which have resulted from imperfect healing after suppuration.

SIZE AND STRUCTURE OF SINUSES.—Both in their dimensions and structure, sinuses and fistulæ differ according to the affection with which they are associated, the time during which they have existed, the amount of inflammation with which they are combined, and many other circumstances. They may be so small that they might be easily overlooked were they not disclosed by the outflow of secretion through them, while in other instances they are of considerable size. In their structure, when they are the outlet for slight suppuration maintained by a fragment of dead or carious *bone*, or by the necrosed fang of a *tooth*, they constitute narrow flaccid canals traversing healthy soft parts. If they have formed in the course of chronic *joint disease* or extensive *necrosis* of bone, and are of long standing, especially if the surrounding structures have been repeatedly or long inflamed, their walls become dense and indurated, or "callous;" while if they have followed large *gunshot, or other wounds*, attended with sloughing and loss of substance, they form canals, irregular both in direction and in calibre at different parts, with secondary ramifications and recesses, and traverse tissues that are converted for some distance around into dense cicatricial material, in which further healing by contraction is rendered very difficult. When they follow *strumous disease*, as of lymphatic glands, or synovial membrane, they partake of the characters of the original disease ; the tissue of their walls is soft and spongy, and ulceration and burrowing are apt to occur.

In correspondence with these differences in sinuses themselves, the *granulations* lining them are found to present many varieties. In recent cases, the granulations are soft, pliant, florid, and ready for healing as soon as the cause which has kept the passage open is removed. In cases of long standing, they are smooth, pale, and weak, like the granulations of an indolent ulcer of the integument. If they form in association with scrofulous disease, they degenerate into the same imperfectly organized tissue which is found in scrofulous ulcers of the surface. In short, sinuses and their lining membranes are subject to all the variations—depending on the character, degree, and duration of the inflammatory and ulcerative processes—which are to be observed in parts exposed on the surface of the body. And in their minute structure they accord with these conditions: the granulation-cells may be healthy, and the discharge may have the microscopic characters of normal pus ; but more frequently the granulations are ill-developed, and the pus derived from them is ill-formed, and mingled with blood-corpuscles and a large amount of fatty material and molecular *débris*.

APPEARANCE OF ORIFICE.—The appearances presented by the orifices of sinuses and fistulæ, and by the surrounding skin, will vary with, and become index to, the condition of the deeper parts. Thus the orifice, opening through normal skin, may be small, and embedded in healthy granulations overlaid with laudable pus ; or it may be obscured by pale, œdematous, projecting granulations, exuding thin serum ; or its edges may be jagged and undermined, and surrounded by livid, congested skin, detached by ulceration from the subjacent cellular tissue ; or it may lie in the floor of a scrofulous ulcer ; or, if it is connected with the escape of urine, the skin surrounding it may be thick, sodden, ruddy, and coarsely tuberculated, while in old cases, or when the patient is exhausted, or when the surrounding tissues are firm and dense, the orifice may be patent, and trumpet-shaped, and lined with smooth scar

tissue almost destitute of granulations. Sinuses derive some of their characters from the structures through which they pass. They are often of great length when they run parallel with tendons, or have been formed within their sheaths, or when they are the outlet for suppuration occurring in bursæ beneath healthy muscles, as under the gluteus maximus, or the deltoid, or under broad expansions of fasciæ, as in the popliteal space, or the side of the neck; while if they pass through structures arranged in planes with loose intervening cellular tissue—as in the abdominal wall—they are irregular and tortuous, and complicated with secondary passages and wide ramifications.

FORMATION OF SINUSES.—The conditions tending to produce sinuses and fistulæ of the kind now under consideration, are chiefly the following:—

(1) Those which are *mechanical*, and which interfere with the ready outflow of matter; as when suppuration has occurred at a distance from the surface, in loose cellular tissue, beneath the expansion of a large muscle, or beneath structures formed in layers which slide one upon another, as in the abdominal wall. Or again when suppuration is deeply placed and the external opening is insufficient, so that drainage is incomplete and matter is allowed to " bag."

(2) Those that consist in the presence of some *persistent source of irritation*, which, though it may be trivial, is sufficient to maintain the discharge of a little pus, or perhaps only of a small quantity of serous exudation. The source of irritation may be the necrosed fang of a tooth, a small fragment of exfoliated bone, a patch of unsound periosteum, the diseased synovial sheath of a tendon, caseous material in the substance of a gland, or some foreign body such as a fragment of glass, of clothing carried in by gunshot or other violence, etc.

(3) Those that are due to *defective health*, or to *constitutional disease*, and which are met with in abscesses following typhoid or scarlet fever; or which depend upon the tubercular diathesis, and predispose to the formation of fistula in ano.

(4) Those associated with the *escape of secretion* from the mucous canal with which the fistula communicates, as in lachrymal and salivary fistula. In some cases in which, during the operation for the extirpation of dermoid and other cysts, the lining membrane has not been completely removed, the portion left continues to secrete serous or sero-purulent fluid, and so maintains a discharge which, though it may be small in amount, is persistent, and very annoying to the patient.

TREATMENT OF SINUSES.—The means by which sinus and fistula may be treated are chiefly: the removal of foreign bodies or any other source of irritation; laying the passage open and leaving it to granulate; the provision of free drainage, either by enlarging the existing orifice by incision or dilatation, or by making counter-openings; the use of drainage-tubes; rest; pressure; injections; the cautery; plastic operations; and—often an essential accessory to local measures—the improvement of the general health.

The *removal of any source of irritation* is all that is required in many instances in which every other method of treatment will completely fail. Unless great caution is used, and a thorough examination made, the presence of some local cause for the persistence of suppuration may be overlooked. In doubtful cases, the passage should be repeatedly, but always gently, explored, and, if necessary, it must be either dilated, or laid open, in order that the exploration may be complete. All surgeons have met with cases in which sinuses have been laid open, packed, injected, and treated in a variety of other ways, to no purpose, and in which, at length, the discovery of some source of

irritation has told why they would not heal. Of these troublesome cases, fistulæ opening on the face, in the neighborhood of the alveolar part of the jaws, and depending on necrosed fangs of teeth hidden by the gum, furnish many instances.

Laying open is a method that is often called for, *e. g.*, in sinuses in the groin, and fistula-in-ano. After the canal, together with any branches that may have formed, has been completely laid open, lint, or some like material, is introduced between the surfaces, so that healing may take place from the bottom by granulation. In examples of old callous sinuses, it is sometimes advisable, after the canal has been laid open, to carry an incision through its opposite wall into healthy tissues beyond, or to destroy the indurated internal surface by scraping, or by the application of caustic. When the condition of the patient or his fear of a cutting operation renders laying open by incision unadvisable, the plan of dividing the tissues between the fistula and the surface by passing a *thread* through the canal, and gradually tightening it, may be resorted to. The method, however, is tedious, and except in a few instances, has fallen into disuse. [The *elastic ligature* is more rapid in its action than the simple thread, and may be sometimes employed with much advantage.]

Free drainage is called for in a variety of cases, but especially in those in which pus collects in loose cellular tissue below the level of the outlet, or at a long distance from it; or in the stroma of a large gland, as the breast, in which burrowing readily occurs. The red-rubber tubes, now so largely employed in the management of wounds, are the most convenient agents; the decalcified bone tubes are too quickly melted; and the spiral wire tubes that have been recommended, while in no respect better than the rubber tubes, are more expensive, more troublesome to introduce, and the source of more suffering to the patient. The tube may be either passed down into the main cavity [by means of a forked probe, as shown in Fig. 310], or be carried on to some further point at which a counter opening in a dependent situation has been made. The *counter opening* is often essential, *e. g.*, in wide burrowing beneath the fascia lata, or near large joints, or (though more rarely) in diffuse abscess in the breast or side of the neck. [It is, in some cases, advantageous to pass a *tarred rope*, or *mesh of oakum smeared with resin cerate*, through the sinus, thus at the same time securing drainage and applying a stimulating dressing.]

Fig. 310.
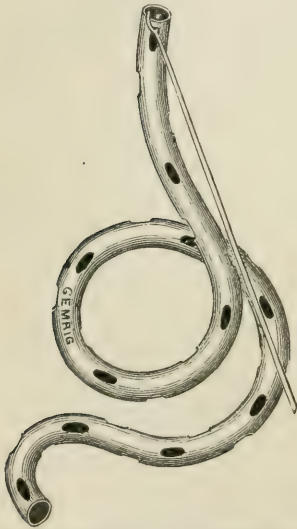
Mode of introducing a drainage-tube by the aid of a forked probe.

Rest must be secured, when the sinus is so placed that it is affected by movement, or disturbed by the contraction of neighboring muscles. Many sinuses in the groin, the breast, or the armpit, and many that are connected with the sheaths of tendons, will not heal until complete rest is secured, either by horizontal posture, or by confinement of the part itself on a splint, or by careful bandaging.

Pressure is sometimes efficacious in recent fistulæ, or sinuses that are superficial, and where the structures can be uniformly pressed against some firm surface; as in the breast, where pressure can be made against the thorax, or in the forearm, or head, or in stumps after amputation; but if pressure be not uniform, it will be hurtful rather than beneficial.

Injections are useful in cases of old and deep or tortuous sinuses, leading into abscess-cavities containing degenerate pus, and so placed, as in the case

of psoas and iliac abscesses, that counter openings cannot be safely made. The best materials for injections are weak solutions of iodine, of carbolic acid, of nitrate of silver, or of sulphate or chloride of zinc. Injections must always be used with caution, and the strength of the solution employed must be carefully guarded and only gradually increased.

The cautery—of which the most convenient forms are the galvanic current-heating platinum wire, and the recently invented benzoline cautery—may sometimes be advantageously employed for the closure of small sinuses and fistulæ left after nearly successful plastic operations, and in other instances of short canals in situations in which a plastic operation would be attended with unusual difficulty. It should, however, be remembered that the effect of the application of the cautery is to render the structures cicatricial, and that if it fail to secure closure of the sinus, it leaves the parts less amenable to other forms of treatment.

Operations.—In many instances in which urine or other excretion passes through a fistula, an essential part of treatment is to provide free escape for the excretion by the natural passage. No treatment will cure a perineal fistula, for example, unless the urethra be restored to its full size by dilatation; and, when this is done, many fistulæ will spontaneously close. *Plastic operations*, as they will be described elsewhere, both in respect to the principles which they involve and the various methods by which they are performed, need not be considered here.

General Treatment.—Where necessary, tonics and change of air must be combined with other means of treatment; the possible existence of tuberculosis must be kept in view; operative interference must be postponed in cases in which there has been recent illness, as any of the exanthemata; and if there is any suspicion of syphilitic taint, active treatment should be delayed till the patient has been subjected to a course either of mercury or of iodide of potassium.

Diffuse Suppuration.

When suppuration follows acute inflammation in those whose constitutions are broken by old age, visceral disease, the abuse of alcohol, privation, residence in bad climates, or other causes, pus, instead of being inclosed in a well-defined cavity, so as to constitute abscess, may be widely disseminated through the tissues of the part. This diffusion of matter is most marked, and most extensive, in suppuration in large areas of loose cellular tissue, as in the pelvis, but it is also frequently met with in the subcutaneous tissue and the intermuscular spaces of the limbs, in the neck, in the armpit, in the ischio-rectal fossæ, and by the side of the rectum, in the breast, under the scalp, etc. It occurs also in the medullary substance of bone, as one of the forms of osteomyelitis, after compound fracture or amputation.

When once established, diffuse suppuration is usually very rapid in its progress, and very destructive in its results. In the course of thirty-six hours, or sometimes even in a much shorter period, the whole of the subcutaneous and intermuscular cellular tissue of a forearm or a leg, may be infiltrated with pus, and reduced to a sloughing condition, so that the skin is undermined and detached from the subjacent structures, and the muscles, tendons, and large bloodvessels are deprived of their sheaths and laid bare. When diffuse suppuration attacks the neck, pus may quickly make its way, under the layers of the deep fascia, into the anterior mediastinum and the cellular tissue around the pericardium, while, when the loose areolar tissue beneath the occipito-frontalis is involved, the whole of the scalp may be raised by a large collection of pus between the muscle and the pericranium.

SYMPTOMS OF DIFFUSE SUPPURATION.—When any case of acute inflammation is met with in the class of patients alluded to above, the probability that suppuration will tend to be diffuse must be carefully borne in mind, for the condition is one that may be overlooked, and one, at the same time, which it is highly important to detect in the very outset. The premonitory symptoms are (1) *swelling*, which is usually considerable; (2) *discoloration*, when the parts are superficial (as in the forearm or side of the neck), the skin being dusky or ruddy, tight, smooth, and very sensitive; (3) *pain*, which is throbbing and "burning," while the patient complains of a sensation of weight and tension. When suppuration has occurred, the tissues are at first *œdematous*, so that they readily pit on pressure; afterwards they become "*boggy*" and soft, and *crepitation* perhaps is felt. The motion is often indistinct, or absent, owing to the fact that matter, even when its quantity is considerable, does not form a circumscribed collection that can be pressed to and fro beneath the fingers, but is disseminated through the meshes of the areolar tissue. It is only, as a rule, when the amount of pus is very large, and the areolar tissue has been broken down, that *fluctuation* can be detected.

The surgeon must depend for the recognition of the existence of pus mainly on the general features of the case—the age, and the constitutional history and present condition of the patient, the aspect of the skin, the œdema and pitting on pressure, and the sensation that the structures are undermined, soft, boggy, and crepitant. In any case of doubt, however, an exploratory puncture should be made. This will do no harm, even if there prove to be no matter, while, on the contrary, its omission or delay may lead to very serious mischief that prompt interference might have averted.

TREATMENT OF DIFFUSE SUPPURATION.—The patient's strength must be supported by the use of quinine, cinchona, and ammonia, or iron, with nutritive food, moderate stimulants, and good air. In choosing the *drugs* to be employed, care must be taken that they are adapted to the condition of the patient in respect to his age, and his powers of digestion. If they induce sickness, or seem to disturb the appetite, they had better be withheld. *Food* is much more important. This must be at the same time nutritive and easily digested, and it must be given frequently and in moderate quantities. *Stimulants*, though they may be called for, must be cautiously used. Given freely, they are apt to destroy the appetite for food; two or three glasses of wine, or from three to six ounces of brandy, are all that, in the majority of cases, can be advantageously prescribed.

Local Treatment.—The local means are *rest of the part* in the horizontal or slightly raised position; *hot fomentations* frequently renewed, or hot poultices; *incision;* and *free drainage.* Of these, early and free incisions are by far the most important. The practice of some surgeons is to make one or two incisions of considerable length—extending, *e. g.*, from the shoulder nearly to the elbow, or from the elbow nearly to the wrist—but it is usually better, both for immediate relief of tension, and for after healing, to employ several short incisions, so placed that the openings are dependent, and drainage easy and direct.

ULCERS.

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An Ulcer is a solution of continuity maintained either by some local cause or by some constitutional disorder. Many ulcers are due to specific causes, and are maintained by specific conditions: these will be considered elsewhere under the proper heads.

I shall confine myself, in this Article, to the consideration of non-specific ulcers, the causes of which are both local and constitutional. Among the *local causes* are such as result directly from mechanical violence, from chemical irritation, or from heat or cold, by which the vitality of a portion of the integument and deeper tissues is destroyed. Other local causes are found in disturbances of circulation, such as varicose veins, constricting bands, tight bandaging, continued pressure, etc. The *general causes* are such as induce an insufficient supply of blood, an improper quality of the blood, or a disturbance in the circulation of blood in the part.

There are certain sites at which ulcers most commonly occur, and these sites are determined by anatomical peculiarities. Unusual exposure to mechanical violence, from position or occupation, predisposes to the occurrence of ulcers. Thus the inner and anterior part of the leg, over the tibia, is the most frequent site of ulcers. The occupations of the laboring classes, by exposing them to injury, the innutrition of the insufficiently fed, and the irregular habits of the dissipated, make the occurrence of ulcers on the shin a very common thing, especially in advanced life. The special exciting causes and the constitutional influences which favor the production of ulcers will be considered in connection with the special forms of ulcers.

Simple or Healthy Ulcers.

These occur on any part of the body, more frequently at the site of election above referred to, and in persons in whom there is no constitutional defect connected with nutrition, circulation, or innervation. They may be due to any mechanical or chemical cause resulting in the death of any of the superficial tissues, including the skin. When a portion of the skin is dead, changes occur in the tissues immediately about the dead part, which result in the disintegration, partial solution, and absorption or throwing off of the tissue so involved. This disintegration in the living tissue results in the separation of the dead tissue as a slough, and this process, when completed, leaves a granulating surface upon which may remain small fragments of dead tissue not yet completely separated. These fragments soon disappear, after which the discharge no longer contains any of the *débris* of the old tissue, but con-

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sists wholly of pus. The surface of such an ulcer is depressed, and red, and presents irregular projections of granulating tissue all over; the margins are bounded by skin which has somewhat more than the usual vascularity, and which is consequently a little reddened. As healing progresses, the margin, of newly-formed skin, appears white; and just within this white margin is a boundary line of a pinkish hue, which shades off into the brighter red of the central granulating portion. The epidermic cells bordering such an ulcer proliferate actively, and, if the ulcer is only protected, the healing process may go on until a perfect cure results. The rapidity of the cure will be determined largely by the character of the tissue immediately underlying the skin. If the connective tissue is long and lax, with an abundance of bloodvessels, the process of cicatrization will be rapid, and the scar left will be small; but if the tissue under the skin is short and tense, so as to bind the granulating surface to a solid structure beneath, the process of healing will be slow, and the scar will be correspondingly large. In the first case, skin is borrowed from the surrounding parts; while in the second instance, new material must be formed to fill the gap.

TREATMENT.—A simple or healthy ulcer, if it is not too large, requires nothing but cleanliness and protection for its cure.

INFLAMED OR PHLEGMONOUS ULCERS.

A simple, healthy ulcer may become inflamed from any of the local or general causes that give rise to local inflammation. This condition, if it occurs during the reparative stage of a simple ulcer, may lead to rapid breaking down of tissue, and consequent increase in the size, and change in the form, of the ulcer; the pink granulations becoming intensely red, then dusky, and finally of an ashy hue. The recently-formed epithelium of the cicatrizing border yields quickly to the disintegrating process, the normal skin about the ulcer becomes swollen, red, hot, and painful, and the tissues at the base of the ulcer become involved, and rapidly disintegrate. The discharge, at first small and thick, becomes thin and sanious, and is made up chiefly of the *débris* of disintegrating tissue mixed with serous elements of the blood. If the patient is weak and cachectic, the inflamed ulcer may rapidly assume a phagedænic character.

TREATMENT OF PHLEGMONOUS ULCERS.—In the very beginning of the attack, a saline cathartic may be administered, and the whole body, as well as the part affected, should be placed in a position of complete repose. Leeches may be applied to the limb—but not too near the ulcer—or the ulcer itself and its distended margins may be scarified. Warm, soothing, and astringent applications should be made to the part, and the limb should be elevated so as to retard the flow of arterial, and promote the return of venous blood. Should the inflamed condition be due in any degree to general causes, the constitutional defect should be sought for and corrected.

SLOUGHING OR PHAGEDÆNIC ULCERS.

In this condition, the dusky, swollen, hot, and painful margins of the ulcer rapidly break down, the smooth livid border is replaced by an irregular, abrupt edge, and the centre becomes deeply excavated.

TREATMENT.—In phagedæna the best food is indicated, with perhaps porter or ale ; sunlight and fresh air are indispensable ; iron and bark may be given, or the potassio-tartrate of iron, which is especially valuable in this condition. The part should be kept at rest, and the local applications should be warm, emollient, soothing, and slightly stimulating. A linseed poultice, moistened with a weak solution of sulphate of zinc, to which laudanum has been added, answers well. Such an ulcer, in a debilitated constitution, is apt to degenerate into the next variety.

WEAK OR ŒDEMATOUS ULCERS.

When the process of destructive ulceration has ceased, and granulations make their appearance, they are pale, flabby, easily broken, and apt to become infiltrated with serum ; the discharge is a watery fluid containing few pus corpuscles, and but little fibrinous material. Such granulations are apt to become redundant and to overlap the parts already cicatrized, so that the forming epithelium does not readily extend over them. The appearance of such fungoid, weak, œdematous masses of granulation-tissue, protruding as they sometimes do through well-defined openings in the skin, may excite a suspicion of malignancy. This suspicion is, however, quickly dissipated by the touch, which shows that the granulations are exceedingly soft and velvety, easily depressed, and altogether unlike the firm, fungous masses which spring up in malignant disease ; both, however, are usually devoid of sensibility. Such projecting masses are apt to be present in ulcers connected with joints and sheaths of tendons. If these dropsical granulations are subjected to pressure, they quickly die, and are replaced by others of the same character.

TREATMENT OF ŒDEMATOUS ULCERS.—In this type of ulcer, the general condition calls for a supporting treatment. Better blood and a more vigorous circulation, general and local, are needed, and we therefore prescribe fresh air, sunlight, good food, malt liquors, etc. Opium, in moderate doses, two or three times a day, sometimes acts well. The local dressings should be of a stimulating character. A solution of nitrate of silver, ten grains to the ounce, may be brushed over the granulations once a day, or, if the granulations are much above the level of the surrounding skin, the solid stick may be passed lightly over them. A linen cloth no larger than the ulcer, thinly spread with resin cerate, should be applied ; this may be covered with a cushion of absorbent cotton, extending an inch or so beyond the sore, and a bandage lightly applied to keep the dressing in position : this dressing may be allowed to remain until the absorbent cotton is saturated, but not longer. The final healing of such an ulcer depends greatly upon the patient's general condition, and every means for its improvement should be carefully sought.

NEURALGIC OR IRRITABLE ULCERS.

Intense pain, or excessive sensibility, sometimes attaches to ulcers, but is not peculiar to any special condition of disintegration or repair. Pain is often associated with an inflamed condition of the part, which precedes or accompanies disintegration, and is often provoked by irritating applications, such as stale or soured poultices ; or it may be dependent on disturbed digestion, constipation, or any intercurrent disease which renders the whole body more sensitive and irritable. It is most frequently present in nervous, anæmic,

or chlorotic subjects.   In a sensitive ulcer, it sometimes happens that a careful search with the end of a probe, moved from place to place, will detect a point of exquisite sensibility; in which case it is probable that a nerve sheath has been destroyed, and the nerve fibre exposed.   Such points may be destroyed by caustic, or cut off with scissors, or the nerve filament may be divided a short distance above the sensitive point, as recommended by Hilton. The pain of such an ulcer is often intensely burning.   The base and margin of an irritable ulcer may become indurated and thickened by interstitial deposit, or the connective-tissue element may die, giving to the ulcer a mottled appearance, like that presented after the partial separation of the slough of a carbuncle.   In such cases, the neighboring skin may also be attacked with pimples, which are red, inflamed, elevated, hard, and painful; these soon develop suppurating points which contain a thick and tough pus, and which present the characteristics of little secondary furuncles.   There is generally some febrile reaction, loss of appetite, etc., leading to the conclusion that the local and general conditions of the patient are not unlike those present in carbuncle.

TREATMENT OF IRRITABLE ULCERS.—In the treatment of irritable ulcers, iron and quinine are required internally.   As a local application, carbolic acid, one part to fifty of linseed oil, answers well; or a solution of ten or twelve grains of chloral-hydrate to an ounce of water, may be applied on lint, covered by oiled silk or sheet gutta-percha, and held in place by a bandage.
The irritable ulcer, in feeble, anæmic, dyspeptic persons, may show no appreciable local change, except that the granulations incline to atrophy, become pale, easily break down, and are scantily renewed.   In this class of cases, a tonic of arsenic and iron answers well; with a generous but carefully selected diet of digestible, nutritious food.   The bowels should be kept open (without purgation) by sulphate of magnesium, to each drachm of which may be added five grains of sulphate of iron.   As a local measure, the ulcer may be brushed with a solution of nitrate of silver, ten grains to an ounce of water, and may then be dressed with an ointment of carbolic acid, ten grains to an ounce of cosmoline, on lint or linen, kept in place for twenty-four or forty-eight hours by means of a smoothly-applied bandage.   When this dressing becomes soiled or uncomfortable, it should be removed, the parts about the ulcer cleansed with carbolic-acid water, and a similar dressing applied.   The dressings should be carefully adjusted, and not renewed as long as the part is comfortable, or the dressing continues unsoiled by discharge.   Perfect rest of the limb should be maintained.

INDOLENT OR CALLOUS ULCERS.

The typical ulcer of this class is the old sore shin of the laboring classes. It exists frequently, without constitutional complications, in robust, healthy persons past the middle period of life.   It is generally the result of an injury more or less violent.   At first a simple sore, it suffers from neglect—the clothing irritates it, and secretions are allowed to collect on and about it; in the beginning it tends to heal like any healthy ulcer, but it is injured again and again, and may go on from year to year without interfering with the occupation of the patient.   It may be large or small, and, when its characteristics are best marked, it is tolerably regular in outline; its surface is depressed, and presents a yellowish-gray appearance, with perhaps here and there red or pink granulations peeping through.   Its edges are abrupt and elevated, and have a bluish cast, with a thick, scaly epithelium coming up

to the very margin of the ulcer; the parts about are hard, dusky in color, and infiltrated. The circulation is feeble, as is shown by the slow return of color after the blood has been driven out by pressure with the finger; the blood circulating in and about the ulcer is largely venous. The ulcer and parts about may be handled rudely without giving pain. Such ulcers are not inclined to bleed. For a time, granulations may spring up, and the healing process go on favorably, but, from the insufficient blood-supply and imperfect tissue-changes in and about the ulcer, the progress is slow, and the new tissue when formed breaks down easily. In fact, the chronic infiltration in the parts about the sore has diminished and retarded the blood-flow; the bloodvessels are changed to stiff, inelastic tubes; and the tissues themselves have little assimilative force.

TREATMENT OF INDOLENT ULCERS.—Such a patient in a hospital, where he can have rest, is easily cured; but, when turned out again to earn a living, some accident soon opens the old sore, and it passes rapidly to its former condition. Let the patient be confined to bed, with the leg a little elevated, a poultice of linseed meal applied and renewed every five or six hours, and, within three or four days, the dry, thick epithelium will entirely disappear, the grayish-yellow secretion of the ulcer will be cleaned away, and granulations of a pinkish hue will cover the surface. Then a solution of chloral-hydrate, ten grains to the ounce, may be applied on lint directly to the ulcer. This may be covered with a piece of sheet gutta-percha, and this with a pad of cotton-wool, all being secured by a bandage snugly enveloping the limb and extending several inches above the ulcer. This dressing should be changed once in twenty-four hours, and the limb washed with a weak solution of carbolic acid every time the dressings are changed. In the beginning, the process of repair will be rapid, the granulations soon reaching the level of the surrounding skin; the indurated border will soften down, and the color will change from its former dark purple to a lighter hue. The progress of cicatrization will be shown by the light pink circle bordering the granulations, and by the delicate new epithelium shading off into the firmer and older normal epidermis. This plan of dressing may be pursued until a broad margin of new epithelium is formed all around the ulcer, and until the healing becomes tardy. At this time the granulations will be smooth, not bright and red from the excess of blood as in rapidly forming granulations, but paler, smoother, and smaller. This is the condition most favorable for grafting.

But all old sore shins do not yield so readily. When the connective tissue is deeply infiltrated; the epithelium dense, horny, and thick; the secretion thin and sticky like peach-gum; the base of the ulcer dense, infiltrated, and devoid of sensibility, more time will be required. The induration of the base and margins of the ulcer may be speedily softened by a warm-water bath continued several days, the water being repeatedly renewed and the softened epithelium wiped off; or a large flaxseed poultice may be applied, and changed every six hours, until the induration has measurably disappeared, and until the ulcer has begun to show granulations on its surface. A fly *blister*, covering the ulcer and extending several inches beyond its margin, should then be applied and covered by a poultice, which should be left undisturbed for six or eight hours; the blister will provoke an abundant serous discharge, which may be encouraged by a pad of absorbent cotton saturated with glycerine. This dressing, continued for several days, will generally leave the surrounding tissues much softened, after which the dressing of chloral, etc., may be employed. Should this course not result in softening of the surrounding parts, they may be painted with the tincture of

iodine every day for a week, covering the limb with a poultice as soon as the alcohol has evaporated. Another method of softening this dense tissue is to make *incisions* down to the deep fascia, in lines radiating from the margin of the ulcer and extending to the border of the indurated tissue, following this with a dressing of glycerine and absorbent cotton as above indicated. Still another method of getting rid of the induration is by the use of Martin's *elastic bandage*, applied to the limb so as to cover the ulcer and its hardened surroundings. After the removal of the induration about and beneath the ulcer, a solution of chloral, or a weak solution of chloride of zinc or of carbolic acid, may be applied on linen and covered with oiled-silk secured by a bandage; or some stimulating ointment may be used. Here, too, the method of Baynton, by *strapping*, may be brought into play with excellent effect. Aided by habitual cleanliness, the ulcer may be thus brought to the stage in which, if very large, *grafting* alone can complete the cicatrization.

The indolent ulcer occurring in the laboring classes, may also be treated successfully while the patient is permitted to pursue his usual avocation, provided he will (as he usually will not or cannot) follow the instructions given by his physician. On returning from work in the evening, let the limb be soaked in warm water for an hour or more, and then wiped dry; let a thick, wet cloth be applied to the entire indurated portion; and let this be covered with oiled silk and a bandage. In the morning, let the part be carefully washed, and let a clean cloth of linen or old soft cotton, folded until it is half an inch or more in thickness, be applied wet to the indurated portion, or still better around the entire limb, and let this be covered with oiled silk and secured by a well-applied bandage. Let this course be pursued, changing the dressing night and morning, and soaking the limb in warm water every night for an hour, until the scaly epithelium has disappeared, and until the indurated tissues about the ulcer have become softened. By the time that this is accomplished, say in the course of a week or ten days, the ulcer will have become clean, its edges will be less elevated, and granulations will appear. When this condition is presented, strapping with adhesive plaster will greatly facilitate the healing; the method of Martin, by the use of the elastic bandage, will, however, be found far more practicable in patients of this class. After an indolent ulcer of the leg is finally healed, the scar-tissue easily breaks down again, either from local injury or in connection with depraved health; therefore, to guard against a reopening of the old sores, the general health should be carefully looked to, and the limb should be protected by some sort of shield. A very convenient and efficient plan is to powder the limb well with dry starch, envelop it thickly with cotton-wool, and cover this with a well-applied starch or dextrine bandage strengthened by longitudinal or spiral strips of thick manilla paper; this should be worn until it begins to soften, and should then be replaced by a fresh covering of the same kind.

Hemorrhagic Ulcers.

These can hardly be said to form a distinct class, but a tendency to hemorrhage should be regarded as a special condition that may be associated with any ulcer. In the *healthy ulcer*, in which granulations are rapidly forming and the immediate vascular supply is abundant through the rapidly-forming new blood-channels, as yet without separate or special walls, blood may easily escape; the pus may then be simply tinged by its color, or the flow may be so free as to constitute a hemorrhage. In such a condition, by the use of mild

astringents, with the supporting and repressing effect of gentle pressure, the blood-flow will be diminished, time will be allowed for the more complete formation of the walls of the bloodvessels, and the hemorrhagic tendency will be overcome. In *scorbutic* patients, and in subjects of the *hemorrhagic diathesis*, ulcers often bleed profusely. In the former of these conditions, the symptoms should be met by the use of fresh vegetables and a general tonic treatment, while in certain other cases the hemorrhage may be controlled by the use of opium internally. In female patients, blood is said to flow occasionally from ulcerated surfaces, as *vicarious of menstruation*. In such a case, those measures, local or general, which tend to restore the normal performance of the menstrual function, may be indicated.

In *varicose* ulcers a vessel sometimes gives way, and the blood flows freely; so also in *sloughing* ulcer a bloodvessel may be opened, and large quantities of blood may be quickly lost; in such cases, the styptic salts of iron, zinc, or lead, the actual cautery, or moderate, though definite, pressure, may best control the alarming symptom. In an ulcer having a tendency to bleed, the blood may infiltrate the new tissue extensively, and thus interrupt the nutrition of the newly-formed granulations and cause their rapid destruction. Under such circumstances, it is best to make a free opening and allow the blood to escape externally, rather than to permit it to remain and decompose with the mass of new tissue the vitality of which it has destroyed.

Varicose Ulcers.

An ulcer occurring on a limb having varicose veins is not necessarily a varicose ulcer. We often see veins much dilated, and coursing in a tortuous way along a limb, without the least infiltration or œdema of the connective tissue or skin, the blood being freely returned through these vessels. An ulcer occurring from injury, or a local inflammation from ordinary causes, on such a limb, even though maintained indefinitely by neglect or repeated injury, does not constitute a varicose ulcer. But in a varicose subject, with enlarged veins radiating superficially in the skin, and with a sluggish flow of blood in the part, the exudation from the vessels may at any time, with or without external causes, become so abundant as to result in complete local stasis, followed by innutrition and death of the tissues. If the exudation is abundant in the *rete mucosum*, blebs may form, and a superficial ulcer may result; if, however, the excessive infiltration involves the deeper layers of the skin, and the subcutaneous tissue dies, a deeper ulcer will be formed. Or a varicose vein may be ruptured by some external injury or violent muscular effort, discharging its blood externally or into the surrounding tissues, and ulceration may follow. Varicose ulcers present all the characteristics of indolent or callous ulcers in an exaggerated form; they occur most frequently in persons past the meridian of life, often in pregnant women, and especially in persons who are compelled to be on their feet most of the time.

TREATMENT.—The treatment of varicose ulcers consists in the use of a warmwater bath, or large emollient poultice, continued until the induration is measurably removed, with rest in a recumbent position, and elastic pressure; the character of the applications to be made directly to such an ulcer must be determined by the especial conditions which it presents. Particular attention should be given to the correction of the sluggish venous circulation: perhaps the *liver* may be enlarged, impeding the venous return through the inferior cava; an enlarged *gland* may check the flow through the great saphe-

nous vein; an habitually loaded *colon* may diminish the calibre of the iliac veins by pressure; an omental *hernia* occupying the crural canal may retard the return of blood through the femoral vein; or a weak *heart*, or valvular disease of that organ, may render the general circulation sluggish. Especial inquiry should be made in regard to these possible causes and complications, and, when found, they should be corrected as far as may be practicable. An occasional mercurial purge, conjoined with measures tending to maintain a constantly soluble condition of the bowels, and aided perhaps by the use of muriate of ammonium, may assist in removing pressure from the vena-cava and iliac veins; a tumor or enlarged gland pressing on the great saphenous vein may, perhaps, be removed by the knife; confining the patient to his bed and to a restricted diet, conjoined with well-adjusted pressure, will frequently enable us to reduce an old incarcerated hernia, and thus free the femoral vein from compression; digitalis will increase the tone of the heart, and strengthen the general circulation; the capillary circulation may be improved by small doses of opium; while the general tone of the system may be raised, and the tissue changes hastened, by the use of iron and strychnine. Strapping, uniform elastic pressure, and skin-grafting, are especially valuable in healing these ulcers; while to prevent a recurrence, continued uniform pressure is generally necessary. This can be best accomplished by the elastic bandage. Hilton recommends that the patient be required to sleep in a bed the foot of which is elevated, so that during the whole night the legs may be kept higher than the body, and the venous return thus assisted by gravitation.

Special Points in the Treatment of Ulcers.

Although in connection with each of the special types of ulcer, a plan of treatment has been suggested, it seems proper that some of the measures recommended should be more fully described, and that the attention of the reader should be directed more particularly to their methods of application, and to the purposes to be accomplished by them.

Blisters.—It is a matter of common observation that in indolent, callous ulcers, or in varicose ulcers of this type, an intercurrent attack of erysipelas may set up a train of processes that greatly facilitates the healing of the sore. So also a burn or a scald, or some caustic application, may excite an inflammation of a more active character in and about the ulcer, and thus materially hasten the absorption of the indurating material which dams up and retards the circulation, and so prevents repair. A large blister applied to an ulcerated limb —large enough to cover the entire indurated portion—will excite a more rapid flow in the sluggish blood current, and also establish a drain through the skin, by which the serous elements of the infiltration will be carried off and the induration lessened. But the benefits of such stimulation are not confined to the drawing off of the serum, for the rapid flow of blood hastens also the tissue-disintegration by which the more solid matters are broken down and absorbed. It is possible, too, that through its influence upon the vaso-motor system of nerves, a blister applied to a limb may influence the rate of flow through the bloodvessels. By acting upon the nervous system, blisters also hasten the general circulation. Whatever theory we may adopt regarding the mode of action, it is certain that the reparative and disintegrating changes in an ulcer are influenced by the application of a blister, and that ulcers often speedily heal after such an application when other measures have been used in vain for months.

STRAPPING.—In indolent ulcers, strapping with adhesive plaster has long been a favorite practice.   To be successful, this dressing should be neatly and smoothly applied, covering more than the ulcerated surface; and there should always be some provision made for the discharge of pus from the surface of the ulcer, as otherwise the effect of the strapping may be rather to prevent than to encourage the growth of granulations.   The limb is first to be thoroughly cleansed and softened by immersion in a warm-water bath, or by the use of a poultice for several days, and it should be well dried before applying the strapping.   The strips of resin plaster are cut lengthwise of the cloth,[1] and of a length and breadth corresponding to the size of the limb to be strapped. For the leg, they should be an inch or an inch and a half wide, and long enough to pass one and a third times around the part.   Each strip should be wiped over with oil of turpentine, to soften the plaster and render it more perfectly adhesive.   The surgeon, taking one end in each hand, applies the centre of a strip to that part of the leg which is opposite the ulcer, placing it so that the two edges shall press equally on the skin; the ends are then carried around the limb and crossed over the ulcer.   At most points the leg is not cylindrical; consequently, in laying the strip around it, the two ends will be found to cross each other obliquely.   The first strip is applied an inch or more below the lower margin of the ulcer, the second strip so as to cover about one-third of the first, and so on until a covering is made for the limb, extending from an inch or more below to an inch or two above the upper edge of the ulcer.   The lower margin of each strip is then lifted with forceps at the line of lapping, and a triangular piece cut out, so that the upper angle of the notch in each strip shall extend above the upper margin of the strip next beneath it; in this way several openings are made through which the pus may find free exit.   A soft, broad pad of absorbent cotton is next placed over the straps, to absorb and retain the discharge, and a bandage is carefully and evenly applied, beginning at the heads of the metatarsal bones and ending below the knee.   This dressing may be allowed to remain from twenty-four to forty-eight hours, or until the absorbent cotton is saturated with pus. The bandage and cotton should then be removed, and, if the plaster-strips still maintain uniform pressure, fresh cotton and a fresh bandage may be applied; if, however, the strips are disordered, or saturated with secretion, they must be replaced by fresh ones.

ELASTIC BANDAGE.—Dr. Henry A. Martin, of Massachusetts,[2] gives, as follows, his method of treating ulcers by means of the "Strong Elastic Bandage."

"For over twenty years I have, with unvarying success, treated all forms of ulcer of the leg by the application of a bandage of what is technically known as 'pure rubber.'   The length of this bandage is ten and a half feet, width three inches, and thickness of No. twenty-one of 'Stubs's wire gauge.'   Into one end, two or three inches of strong linen cloth is inserted, and to this is strongly sewed a stout double tape eighteen inches long.   It is important that the edges of the bandage should be perfectly even.   If there is the slightest notch in them, the bandage will be very apt to tear at that point, and become useless.   If, however, it be properly cut, it will bear almost any amount of continued traction.   This even cutting of the bandage can only be done by machinery. . . . . It is astonishing how long a properly made bandage will wear.   Many of my patients are wearing them every day, and have done so for two, three, even four years, and I have cured several successive poor patients' ulcers with a single bandage which is still perfectly serviceable.   To insure this dura-

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[1] If the strips are cut crosswise of the cloth, it will be found that the margins will stretch more than the centre, and that the pressure will be greater under the central line of each strip than at its margins.

[2] Transactions of the American Medical Association, 1877, vol. xxviii., page 589 et seq.

bility, the material must be the best Para rubber, prepared with the minimum of sulphur and heat needed to effect that 'curing' of the gum, without which it would very soon deteriorate and become worthless.

"The dimensions given are those which I have found most generally applicable. If a leg is *very* long and large, an addition of two or three feet in length, and of half an inch in width, may be desirable. In a few cases, where a varicose condition of the veins of the thigh accompanies the ulcer or ulcers on the leg, I apply a bandage from the foot to the groin; this must be from eighteen to twenty-one feet long, and, if the limb is very large, a width of three and a half or even three and three-quarters inches may be requisite. If the leg is very slender, there will be somewhat more bandage than is necessary; this, however, can be wound round below the knee, or, of course, cut off to suit the exact requirements of the case. After being in use for a short time, the bandages improve in appearance by getting rid of the sulphur, which, to use a technical phrase, 'sweats out' of the rubber. This sulphur is not at all objectionable except in appearance; indeed, I think I am not fanciful in believing that, in certain conditions of the skin, it exercises a decidedly beneficial effect. The sulphur could be removed and a much nicer looking bandage produced, but this could only be done by certain chemicals which would probably injure the rubber. . . . .

"The form of ulcer which yields most perfectly and readily to this treatment is that very common one connected with a varicose state of the superficial veins. It is well known how unsatisfactory all previous methods have been in this class of cases, how next to impossible to obtain firm, sound cicatrization of such ulcers without a very long continuance of the horizontal position, and how extremely liable they are to return, at the slightest provocation, when the erect position is resumed. The ulcers found on old poorly-nourished legs, where there is a deficiency in the quality or quantity (generally both) of the blood, a feeble heart, imperfect circulation, and, consequently, a wretchedly-nourished skin—those which were called chironian ulcers by the ancients, deemed by them incurable, or curable only by the Centaur Chiron, or one of his professional equals; round or approaching round, with perpendicular sides, as if cut with a punch through the much thickened skin, with white, hard, almost cartilaginous edges—yield the least readily, but still are healed by this method more speedily and much more solidly and enduringly than by any other.

"I need occupy but little space in describing my way of using the bandage, for nothing can well be simpler. The patient is directed to put it on the first thing in the morning, before the veins of the leg become distended by the impeded column of blood within them. The very best way is to apply it while still in bed. It should be applied with just snugness enough not to slip down. The moment after the foot is put to the ground, the limb is so increased in bulk by the increase of blood in its veins, that the bandage becomes of precisely the proper degree of tightness, and, no matter how active the exercise or labor of the patient, it will remain in position all day. The bandage is applied by winding one turn just above the malleoli, then one round the instep and sole, then up the leg, spirally, round and round, to the knee, each turn overlapping that below it, from one-half to three-quarters of an inch. If there is any redundant bandage, it can be wound round the leg below the knee, the tapes carried in different directions and firmly tied. When the patient undresses at night, the bandage is to be removed, and the limb wiped dry; a piece of soft old linen moistened with olive oil, or some equally simple dressing, laid on the ulcer and retained in place by a few turns of an ordinary roller. The bandage should be sponged with water (cold will do, but warm is better), and hung over a line to dry, in readiness for the morning; or it can be wiped dry at once, and rolled up with the tapes in the centre. Such is the dressing for the night; in the morning the leg can be washed, but, whether it is or not, all traces of oil or cerate should be carefully wiped away, as contact with the bandage of any fatty matter would tend gradually to injure the rubber.

"This is the whole treatment. Rubber bandage all day, with erect position and exercise. The simplest possible dressing (merely to protect the ulcer from injury), with the horizontal position and rest all night. When the bandage is removed at night, it and the leg will be found to be bathed in moisture. That part of the limb to which the bandage was applied has been all day kept warm, moist, and perfectly excluded from the air, in an atmosphere and conditions the most favorable possible for the pro-

cesses of granulation and cicatrization. In addition to this, a gentle, continually maintained, and even pressure has supported the distended and weakened vascular coats, and prevented that venous turgescence which is the cause, in many ulcers, of malnutrition of the skin, the sole reason why nature's ordinary processes of repair are impeded and prevented. In those cases where no varicose condition of the veins exists, but in which an imperfect and feeble nutrition of the skin is the *raison d'être* of the ulcer, where nature is unable to heal the slightest scratch, and the most trivial contusion rapidly changes into an indolent ulcer, with white, elevated, leathery edges, the bandage, by the warmth and moisture induced by its application, favors the circulation in the capillary vessels, and a determination of blood to the surface. The constant pressure is at once a stimulus to the process of granulation, and to the rapid absorption of the hard edges, the · removal of which, in some way, is a necessary antecedent to cicatrization. During the first week or two, and in a few cases for even nearly three weeks, an eruption appears under the bandage, sometimes of few, sometimes of many papules, running very rapidly into suppuration. Each of these indicates an obstruction in one of the cutaneous follicles. The bandage is their best possible treatment, for the moisture softens the indurated secretion, washes it away, or favors the rapid suppuration by which nature accomplishes the same object, and, in a very short time, the skin of the leg, subjected to a daily and all-day Turkish bath, becomes entirely clear of all obstruction, and so continues, however long the bandage may be worn. Often ulcerated legs evince other evidences of malnutrition of the skin. Without enumerating or classifying these, all I need say is, that all, however diversely named in the terminology of that great science of words, dermatology, are more or less decidedly benefited by the bandage. . . . . .

"An apprehension has often been expressed by physicians, of œdema of the foot, as a consequence of applying the elastic bandage as I have directed. Such apprehensions are needless. It is a fact, and illustrates the manner in which this method proves so efficient, that a properly applied bandage of this sort does not produce œdema of the foot. If œdema appears, it is because the bandage is on too tightly; applied with the degree of closeness I have indicated, it does not *stop* the circulation in the veins, but, by supporting the walls of the distended tortuous vessels, facilitates the passage of the blood through them, and, in this way, not only does *not* produce œdema, but rapidly removes that which often, to a certain degree, complicates ulcer of the leg.

"Another and very important point is that of wearing the bandage *after* an ulcer is quite well, as a preventive of its return; many of my patients do this continually by preference, even when not directed to do so. I advise all whose occupation tends to aggravate a varicose condition of the leg to wear the bandage while standing, both for the palliation of the symptoms of the varicose veins, and as a preventive of the return of ulcer. Other patients are directed to wear the bandage when obliged to be much on the feet, or if there is the slightest irritability or redness at the seat of former ulceration, indicating a possible tendency to breaking down of cicatricial tissue. This is a most important point. The surgeon must bear in mind the tendency of cicatrices to break down from slight causes, and, particularly, where there is a diseased condition of the veins; and instruct his patient to have his bandage always ready and in good order to be applied at once if needed. The cicatrization of ulcers under the rubber bandage is much firmer and better than, as a rule, I have observed to result from other treatment, but, of course, is not exempt from the tendencies and infirmities of all such tissue."

Since the publication of Dr. Martin's article, in 1877, the elastic bandage has been very generally and successfully used in the treatment of indolent, callous, and varicose ulcers.

INCISIONS.—When ulcers have existed for a long time, and the surrounding tissues have become indurated, the compressed bloodvessels become adherent to the surrounding parts, and are converted into stiff, unyielding channels, through which the blood flows sluggishly. The surrounding tissues, too, become tense and unyielding. Now, as ulcers are closed in a great measure by skin borrowed from the surrounding parts, it is evident that any practice

which tends to soften the indurated tissues, and thus both to free the blood-vessels from peripheral pressure, and to permit the sliding of the skin toward the ulcer, will be favorable to the healing process. Thus incisions through the dense tissues about an ulcer—but not so near as to sever the vessels that go directly to it—are of benefit by permitting the discharge of a portion of the infiltrating serum; but besides this, the cuts will be found to open, thus proving that there has been also a relief of tension at the margin of the ulcer. The incisions, which should be kept open by strips of linen, form also new sites for the process of cicatrization, and that in tissues where the power of repair is greater than at the site of the ulcer itself. Incisions made about an ulcer should be in a general way concentric with it, but should not be made all in the same line; they should rather be allowed to pass each other, as a tight boot is sometimes cut to relieve a swollen joint from too great pressure; thus:—

PLASTIC OPERATIONS FOR OLD ULCERS.—An operation by Prof. Frank H. Hamilton, proposed in 1846[1] and executed in 1854,[2] deserves a passing notice. A flap of skin, raised from the calf of the sound leg, and still attached by a broad pedicle, was transplanted to the site of the ulcer, in which a bed was prepared for it by dissecting out the granulations and part of the cicatrix. In the case reported, healing was accomplished in about one hundred days, after the loss, by sloughing, of a portion of the flap. From his observation of this case, Prof. Hamilton announced the important fact that "if smaller than the chasm which it is intended to fill, the graft will grow, or project from itself new skin to supply the deficiency."

SKIN-GRAFTING.—In 1870, M. Reverdin in France, and after him Mr. Pollock and others in England, published cases in which small bits of skin had been transplanted upon the granulating surface of ulcers, and had formed new centres for the development of epidermis. The same year, Mr. Cumberbatch succeeded in transplanting skin-grafts taken from a leg four hours after amputation; and M. Marc Sée proposed to substitute epidermic scales for the bits of skin which had been previously employed as grafts.

In 1871,[3] I published some comparative experiments in "cell or skin-grafting" by transplanting small bits of cutis, by powdering the surface of the ulcer with dry epidermic scales scraped from the thick cuticle of the foot, and by spreading upon the granulating surface flakes or sheets of detached epidermis. All of these plans yielded excellent results, but the epidermic scales and sheets seemed on the whole to do better than the deeper skin-grafts. Within the past year, Dr. B. Bribach, lately an assistant at the St. Louis City Hospital, has, at my suggestion, made comparative tests of the two methods, and has found the epidermic cells to answer quite as well as the skin-grafts. Dr. E. Studer, now an assistant at the same hospital, has repeatedly grafted with old dry scales of epidermis, with flakes of loose epider-

[1] Buffalo Medical Journal, vol. ii. p. 508.
[2] New York Journal of Medicine, vol. xiii., New Series, p. 169.
[3] St. Louis Medical and Surgical Journal, vol. viii., New Series, July, 1871.

mis peeled off from any part of the body, and with thin shavings taken from corns. He prefers the latter material to any that he has tried, and his results have been as good as I have ever seen where more deeply-cut grafts have been used.

During the winter of 1879–80, Dr. E. Fischer, of Strasbourg,[1] experimented upon skin-grafting by what may be called the bloodless method : an artificial anæmia of the limb to be grafted is produced by the application of Esmarch's elastic bandage, taking especial care to avoid disturbing the granulations. The elastic rubber tube is then adjusted, the bandage removed, the grafts applied, and the dressing completed by a protective of silk, which is fixed in place by strips of adhesive plaster, and covered by a layer of muslin and one of sheet gutta-percha, and a gauze roller. The grafts are taken from an amputated leg, to which Esmarch's bandage has been applied either before the amputation or immediately afterwards. They are cut in the form of thin strips, from two to three centimetres in width and of any desired length, cutting always in the thickness of the cutis, and never including any of the subcutaneous tissue. These large dermo-epidermic grafts are said, as a rule, to adhere perfectly to the granulating surface, and without the separation of the epidermis which generally occurs in skin-grafting.

For success in skin-grafting, it is essential that the granulating surface be in a proper condition. If any _débris_ of dead connective tissue remains mingled with the granulations, if the discharge from the granulating surface is profuse, or if the granulations are large, irregular, and very vascular, the surface is not in the best condition for planting grafts. If we carefully observe an actively healing wound, we shall see, at the margins where the process of cutification is going on, a border of smooth, granulating tissue, from which there is little or no secretion, and over which the new epithelium is rapidly extending. Such a smooth condition of the general surface of the ulcer is favorable for grafting. If the granulations are rapid in growth, with abundant formation of pus, they may be repressed, and the secretion diminished, by a dressing of lint wet with a one per cent. solution of carbolic acid, covered with oiled silk, and secured by a snugly applied bandage.

Fig. 311.
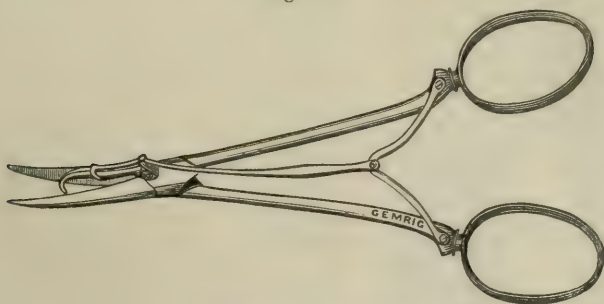
Scissors for skin-grafting.

The manner of grafting, and the dressing and after-management, have much to do with the success of the operation. If small bits of skin are used, they may be most conveniently placed in rows across the ulcer, at right angles to the length of the limb, and covered with strips of sheet gutta-percha just wide enough to cover the grafts; the ends of the strips, which should be long enough to extend beyond the margins of the ulcer, are then moistened with

[1] Deutsche Zeitschrift fur Chirurgie, Bd. xiii.

chloroform, and thus made to adhere to the skin; over this I have found it best to apply absorbent cotton or some other similar material, to absorb the secretion. After a day or two, or when it is thought desirable, the dressings are changed, leaving the strips of gutta-percha undisturbed; they should not, as a rule, be removed for six or eight days, at the end of which time the grafts will generally be found firmly adherent to the granulating surface. [The grafts may be cut with a delicate knife or lancet, or, more conveniently, with the scissors shown in Fig. 311.]

When broad sheets of epidermis are used as grafts, it is desirable to cover these completely with sheet gutta-percha. But both the grafts and the gutta-percha should have small openings cut in them to allow the discharge from the ulcer to escape; otherwise the secretion will be apt to lift the grafts from the granulating surface.

When the surface is in proper condition for grafting, the proceeding rarely fails, and very large ulcers may often be covered by a new epidermis in the course of a week or two.

Dr. J. H. Girdner, formerly resident-surgeon at Bellevue Hospital, New York, has published a remarkable case of skin-grafting, in which the grafts were taken from a dead body :—[1]

C. J., aged ten years, who lives in Morrisania, New York, is the original of the photograph from which the accompanying cut (Fig. 312) was made. In the latter part

Fig. 312.
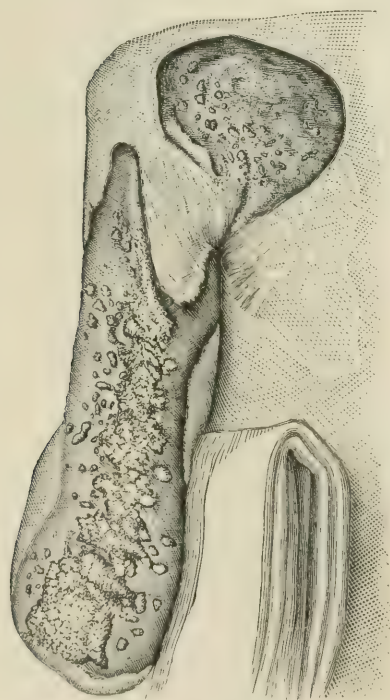
Case of skin-grafting in which the grafts were taken from a dead body. (Girdner.)

of June, 1880, while sitting on a door on which there was a steel hinge, he was struck by lightning, and became comatose, in which condition he remained for several hours. He was brought to Bellevue Hospital and placed in ward twelve, at that time under my charge. When his clothes were removed, the skin came off his left arm and shoulder, leaving the large raw surface seen in the picture. This surface was treated by different means for some weeks, until a healthy granulating surface was obtained all over the affected part.

About this time a healthy young German, who had attempted suicide by cutting his throat, was brought to the hospital, and died within a few hours. Six hours after his death I went to the dead-house, and removed a portion of skin from the inner side of the thigh, where there was least hair, and where the skin was most delicate. Having cut this piece of skin into a great many small pieces I applied them, and dressed the surface [with Lister's protective, adhesive plaster, and a bandage]. After the dressings had remained on for four days, they were removed, and after some little discharge had been washed off, I had the patient photographed. About one-fourth of the grafts had failed to take, and were washed off when the wound was cleansed. The remainder had attached themselves to the ulcer, and, as will be seen from the cut, the lower and central portions of the ulcer on the arm were already covered with a thin, delicate skin, as a result of the fusing together of the little islands of skin, each graft serving as a point of departure for the formation of these islands. [The progress of the case was complicated

[1] Medical Record, July 30, 1881.

by an attack of erysipelas, and other graftings were required before the cure was completed.]

AMPUTATION FOR ULCERS.—Since the practice of skin-grafting has been generally adopted, amputation for superficial ulcers of the limbs has been rarely performed by intelligent surgeons. And to-day, no competent surgeon would think of amputating a limb for a superficial ulcer, even though it entirely surrounded it. If, however, the muscles and deeper tissues have been destroyed to such an extent as to render the limb useless, amputation may be performed with propriety, and may even be demanded, in cases in which an artificial substitute will render better service than the diseased member.

GANGRENE AND GANGRENOUS DISEASES.

BY

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GANGRENE.

(*Mortification.   Sphacelus.*)

THE terms GANGRENE and MORTIFICATION must be regarded as Greek and Latin synonyms, for while they include the condition of death or SPHACELUS, they also imply the process of dying as applied to a particular portion of the body.   Of course in a process of this kind, no positive line can be drawn between the living and the dead.   The symptoms which indicate the presence of gangrene are both of a local and of a general character.   It is impossible for even a small portion of tissue to be in a gangrenous condition without producing constitutional symptoms, and these vary in a degree out of all proportion to the amount of tissue thus affected.

Life is sometimes lost by poison generated from a small surface, and at other times a limb may become gangrenous up to the knee, and if the progress of the disease is not too rapid, the constitution will resist it so as to allow the process to terminate and life to be preserved.

The constitutional disturbance is essentially due to the absorption of exudates, which being already necrosed must be passed through the organization and thrown off by the emunctories.   Such a process must have a depressing tendency depending partly upon the amount to be carried off, and partly upon its character.   It is true that we know but little of the chemical construction of these exudates, which contain fluids so intensely virulent in their action that a mere scratch is sometimes sufficient to induce a fatal gangrene, while in other cases they are so mild as to allow the process of dying of a whole extremity, as a hand or foot, without seriously endangering life.   This remarkable difference of intensity gives color to the belief that a variety of poisons must be generated in the act of decomposition, and the chemists furnish by their analyses substances which differ in the various forms of gangrene.   But no evidence exists of the production of septicæmia from any one of them.   Neither can the experiments with the so-called sepsin be considered conclusive.   Nor can we yet accept the doctrine of "bacteræmia" without reserve.

CAUSES OF GANGRENE.

The *causes* of gangrene are very numerous, but in one way or another they mostly consist of an arrest of the circulation.   Still it is not merely the condition of the circulation that determines its production.   The cell has a life which may be destroyed by the presence of poisons while the circulation still

persists. The very exudate which is extruded into the tissue around the carbuncle, or in hospital gangrene, becomes a poison which may destroy the life of the cell. Pushed along the connective tissue unrestrained by any power of organization or coagulation, the cell is destroyed by its presence. Chemical substances by their direct action will produce gangrene in the tissues. Sudden heat, as in a burn, or excessive cold, will instantly destroy cell life. Sudden arrest of the circulation, as in the ligation of an artery, tight bandaging, or severe and constant pressure, illustrate some of the common causes of gangrene. Besides these, we have arrest of circulation caused by the inflammatory process, where the stasis has become perfect over a considerable portion of tissue, thus practically cutting off nutriment from the cell.

Among the causes of gangrene must be enumerated deficient nerve power. Paralytics are special sufferers. Still the condition is so complicated with another well-known cause, that it is difficult to know how far to the mere diminution of nerve force the gangrenous result may be attributed. In these subjects protracted pressure is almost sure to be brought upon special points, and this we know to be a fruitful cause of sloughing.

Symptoms of Gangrene.

The *symptoms* which mark the invasion of gangrene present to us a wide range of activity, which obviously depends upon the amount of absorption of the diseased products combined with the activity of the inflammatory process. To this we must add as above stated a difference of degree in the intensity of the poison. When the gangrene arises from an inflammatory cause, the danger is largely to be measured by the extent of surface and the character of the tissue invaded. When in addition to gangrene of the skin we have a joint like the ankle opened into, the absorption of poisonous exudates is far more rapid. The inflammatory fever now readily changes to one of a typhoid type. The *pulse*, which was full and strong, becomes small and feeble, and more rapid. The *surface*, which was hot and perhaps dry, becomes cool and clammy. The *skin* assumes a pallid hue. The *tongue* is dry, with dark fur, the *teeth* covered more or less with sordes, *respiration* is hurried and sighing. The *nervous system* is utterly prostrate, as shown by a wandering mind, subsultus tendinum, dorsal decubitus, tympanitic abdomen, with involuntary discharges, and retention of urine.

The *local symptoms* consist of gradually occurring changes marked by a diminution of sensation and of bodily temperature. Immediately preceding the occurrence of gangrene, pain is apt to be severe, and the color is an intense red. But with the diminution of pain the color becomes darker, then purple, then black, or of an ashen hue. Step by step with the other symptoms, decomposition goes on, accompanied with a fetor which is characteristic, and, which, when once recognized, will always be recollected.

Arrest of Gangrene.

When gangrene is about to cease its progress, the change in appearance commences slowly, somewhere in the doubtful, debatable space between that which is known to be living and that which is known to be dead. An alteration in color and appearance marks a change in the pathological condition. The exudate, which, during its progress, has been incapable of organization, begins to cut off the dead from the living by filling the areolar spaces and establishing a line of circumvallation. It has been said that there is no

PLATE IV.

Senile, Dry, and Moist Gangrene

essential difference between ulceration and gangrene, the former being merely a cell-death, so slowly carried on that the tissue becomes converted into fluid, and is thus washed away with the exudate from the blood which now appears upon the surface. As a result of the retention of the exudate, commencing a process of organization, we have a heightened capillary circulation, and the color changes from the dark hue to a paler one, and then to a red, the last being the condition which clearly marks the arrest of gangrene. This red line, looked forward to by the surgeon, is of course produced by the return of the true circulation. The various tissues have different powers of resistance to the spread of gangrene; the loose connective tissue, by permitting the poisonous exudates to enter it with facility, gives way more easily than others. The aponeuroses and tendons also, from their feeble vascularity, seem to have less power of resistance than the skin or muscle, and hence it is a very common thing to find the fascia of muscles dead at a point considerably above the line of demarcation either in them or in the skin.

Varieties of Gangrene.

The different appearances which gangrene assumes have led to subdivisions which sometimes indicate the cause.

Inflammatory gangrene is preceded by the condition of inflammation, in which the part is red, hot, and swollen. The stasis here becomes absolute, and the tissue passes from red to purple, and afterwards to the ashen hue or black, when sphacelus is reached. This form is a variety of *moist gangrene.* But moist gangrene (Plate IV., Fig. 3) does not necessarily arise from the inflammatory process. It may occur when the obstruction is from pressure that distends the veins without compressing the arteries, as from too tight bandaging. The tissues become swollen and distended by exudates, which rapidly decompose, with abundant, fetid, fluid discharges. But even when the arterial circulation is not entirely cut off, but only diminished, we may have moist gangrene occur, as in the senile form, though the opposite condition of dry gangrene is here more common.

Dry gangrene (Plate IV., Fig. 2) is caused by such an insufficient supply of blood as to destroy the vitality of the part, and yet not load it with fluids which would prevent it from contraction. It therefore takes on a shrivelled and mummified appearance. The portion affected, as the foot, retains its form and shape in consequence of the unchanged condition of the bones, but the soft parts are shrunken and corrugated, and emit a sound like parchment when struck, the whole acquiring a deep black color. It is not always necessary, however, that this form of gangrene should be the result of an insufficient supply of blood, as in senile gangrene, or when it results from embolism. Traumatic causes, as when severe pressure has been brought to bear upon a limb, though usually resulting in the moist form, will sometimes present very perfect specimens of the dry. It may therefore be seen that these forms of gangrene do not necessarily present sharp lines of separation, and that the condition depends chiefly upon the quantity of fluid retained in the tissue, which, in the moist variety, carries on the processes of decomposition more rapidly than in the drier forms.

Treatment of Gangrene.

The *treatment* of an inflammatory condition verging towards gangrene, does not differ from the treatment of inflammation generally; but it must be

recollected that the loss of vitality is due to the stasis in capillaries, and also to the obstruction to the circulation in larger vessels from the severe swelling and tension of the part. Having exhausted the ordinary remedies for the treatment of inflammation, which need not be considered in this place, we may add the free use of incisions, which take off the pressure incidental to the swelling, and also allow an opportunity for the exudates to escape. This treatment, in certain places, may be used very early to guard against the danger of gangrene. In the periostitis which is so common during childhood and adolescence, and which is so sure to result in gangrene of the bone, division of the periosteum should be resorted to promptly. When gangrene has already supervened, the treatment which was proper in the inflammatory stage must be entirely abandoned. Stimulants, tonics, especially quinine and iron, together with nourishing and easily digested diet, beef-juice, milk punch, and such farinaceous food as may be borne, should be administered. The temperature of the part should also be carefully maintained.

Local applications are not of much avail, but some are useful in promoting the separation of the sloughs and decomposed fluids, which may thus be removed from contact with absorbing tissues, and also in destroying the poison in the atmosphere breathed by the patient. For this purpose, covering the tissue with a fine powder of recently prepared charcoal, which has great power in absorbing fetid gases as well as the dangerous fluid of decomposition, was the resource formerly relied on, and, if frequently renewed, possesses no mean ability in effecting these desirable objects; but its dark color, and the necessity of frequent renewal, are such objections to its use, as to cause it to be superseded by solutions of various kinds applied by the aid of lint. Among these we may mention Labarraque's solution, chlorine water, carbolic acid water, permanganate of potassium, sulphate of iron, and bromine. It is needless to say that the end is best obtained by the very frequent renewal of any of these applications. As an aid to cleanliness, it is useful to remove such sloughs as can be conveniently separated without hemorrhage, and thus allow the poisonous fluids to be washed away.

The use of *warm water*, in the condition of lowered vital power antecedent to and accompanying gangrene, has always had its advocates, and has received especial attention from modern surgeons. The continuous immersion of the part affected, in water at 100° Fahr., maintains the temperature so near the normal point, and so equably, that it would on theoretical grounds be clearly indicated. This is well substantiated by experience. I know of no method so likely to arrest the progress of gangrene or avoid the dangers of septicæmia, as the immersing of the part in tepid water. My custom in cases of severe injury, such as the crush of a foot from railroad accident, especially in young subjects, is to secure the patient from hemorrhage, and then immerse the part in water kept at the temperature above indicated. We know that the foot, or part of it, is dead from the injury, but we do not know the line between that which can and that which cannot live. Amputation may still leave tissue that must die. To avoid this great danger, the cautious surgeon feels the necessity of not taking his flap from parts of doubtful vitality. This practice of immersing the whole in warm water will save the injured tissue that can possibly live, and with very little danger from the effort of nature to separate the dead from the living. The red line in such cases is usually formed in a few days, and furnishes the boundary that can be trusted for amputation. The water needs frequent renewal, depending upon the extent of the gangrene, and must be kept up to the standard temperature, rather above than below 100° Fahr. Usually the patient's sensations can be well trusted to direct the degree of heat. The practical application is often difficult without special apparatus, but ingenuity must be able to

supply the want of this, even in isolated places. Swathing the part in cotton, and then enveloping the whole with a rubber or oil-silk sheath, so as to control the flow of water, is a plan that secures the object almost as well as immersion, and is far more convenient. With such an arrangement, a constant stream of water can be supplied at a still higher temperature, such as 105° or 106° Fahr.

This apparatus will both exclude the atmosphere and keep the temperature uniform. We owe the introduction of this method to German surgeons, and in this country to the earnest recommendation of Professor Frank H. Hamilton.

AMPUTATION FOR GANGRENE.

The question of *amputation* for the relief of gangrene is one that has given rise to a great deal of discussion. It has long been known, from ample trial, that if it is practised during the progress of the disease, it is very likely to be fatal. That this should be so, might be inferred from the fact that we cannot always, nor even generally, know the site of the cause that is producing the gangrene, and when we add to this the depressing influences arising from the septicæmic condition, we can very well believe that the patient would succumb to so severe an operation as amputation. When the red line has formed, the constitution almost surely exhibits an immediate and marked elevation of its powers. Moreover, the capacity of the stump to heal is much insured by the very vascularity developed by nature in throwing off the dead tissue. The experience of surgeons then has declared itself in favor of the practice of waiting until nature has thoroughly arrested the progress of the disease. Neither are they in haste to make the knife follow her declaration of the arrest, until the abundant exudate becomes in itself a depressing condition.

But although this rule has so large an application, there are conditions which tax the judgment of the surgeon to the utmost. These are chiefly seen in the form of gangrene which originates from severe traumatic causes. Such cases in their nature follow no rule. A foot may be crushed without any injury to the leg, and the gangrene would be expected to extend to the extent of the injury. But it may not be arrested at this point. We may find that it is spreading with rapidity into the uninjured parts above. It is obvious here that the gangrene is self-propagated. The exudates extruded into the connective tissue produce the severe constitutional symptoms incident to gangrene, and the patient is in danger of rapidly succumbing to the septicæmic process. Under such circumstances, amputation must be performed sufficiently far from the dying tissue to cut off the cause which now creates the gangrene. Again, we may have the whole leg and foot hurt by some severe pressure, like that of a heavy stone, or wheel, passing over it, when there are some parts injured more severely than others. Gangrene may originate in the foot, and afterwards suddenly appear upon the leg at some point that had received a severer injury than the intermediate parts. In such a case, the whole of this tissue is almost surely destined to become gangrenous. This immense mass of necrosed fluid lying in tissue still capable of absorption will determine almost necessarily a fatal prognosis. In such a condition as this, expectation of a red line forming is nearly futile, and amputation is immediately demanded. Of the great surgeons of the past, Larrey was prominent in urging this practice. But if a high fever has supervened, it is very doubtful whether amputation is the proper expedient. The writer has been twice disappointed in amputating the thigh

when gangrene had begun, and when the point of injury could be clearly defined. The crush in one case was by a large stone, and in the other by a rope drawn tightly around the leg below the knee.

Perhaps in these cases, which were not presented to observation until several days after the accident, the delay may have accounted for the fatal result. There can be no doubt that the chances of preserving life where amputation is proper, in cases of spreading, traumatic gangrene, are very much increased by its performance upon the first appearance of the disease.

This rule does not apply when ligation has been performed upon a healthy artery. I have known the whole amount of gangrene after ligation of the subclavian to consist in the loss only of the little finger. In this case, the collateral circulation became sufficient to supply nutriment to the whole arm and hand with this exception. If, however, injury of any degree of severity had been also inflicted upon the soft parts of the arm in connection with the ligation, amputation at the shoulder-joint would have been the correct practice, upon the appearance of gangrene in the little finger.

Hospital Gangrene.

(Synonyms: *Sloughing Phagedæna*; *Pourriture d'Hôpital.*)

This is the name given to a form of gangrene which attacks open surfaces, whether recent or granulating. It does not seem to have the power of acting upon uninjured parts, but any wound, however small, may become its seat. Its name is derived from the fact that it sometimes appears to arise spontaneously in hospitals which are overcrowded, and in which the sanitary arrangements are imperfect. Hence, it more frequently appears in military than in other hospitals, for in them both the requisite conditions are apt to be present after the confusion incidental to military movements. When it has once commenced, it seems to be able to spread, even in places where good sanitary arrangements are maintained. The affection is unknown in the modern hospitals of civil life, and yet when the soldiers, during our last war, were introduced into the best of these, it was found that the disease was readily communicated to the patients already there.

Symptoms of Hospital Gangrene.—The signs of invasion are exhibited by the covering of the surface with sloughs. The disease will often show itself upon one portion, perhaps only the edge, of the wound, and will thence extend over its whole surface. The sloughs are of varying consistence, coinciding with the strength of the tissue involved. The sore swells rapidly, and is, at first, of a livid, red color, and afterward, grayish, or black, with a tendency to become circular, and the whole surface is covered with a grayish or a brownish exudate flecked with black spots, and bleeding readily upon being touched. The pain is apt to be severe, burning and aching, and sometimes lancinating. When a large wound, like that of an amputated thigh, becomes involved, all the tissues, the muscles, vessels, bones, and aponeuroses suffer from the gangrene. But this disease has a tendency to spread in the areolar tissue more rapidly than in those that are firmer. When we look at the skin, and observe its line of dark gray extending for less than half an inch from the edge, we do not recognize the fact that the extension of the disease is still greater in the tissue below. It creeps up between the fascia and muscles to a point beyond the surface exposed.

The *general symptoms* are those observed in other forms of gangrene. The patient is uneasy, anxious, and complaining of the great suffering in his sore. The pulse is slightly quickened, though often very rapid, the temperature a

little elevated, the tongue reddened, and anorexia constant; but neither bowels nor stomach are disordered at first. Soon, however, the pulse becomes more frequent and small, the skin dry, and the prostration great; the bowels are sometimes loose, but generally not disordered, and the face wears a pallid and dusky hue. The progress of these symptoms increases, until the patient sinks into a state of apathy.

This is a description of a fatal case running its course in a few days. Besides these symptoms, the fetor is strong and peculiar, and when once observed is easily recognized.

TREATMENT.—The *treatment* of hospital gangrene is essentially *local*, for although cases recover without special local treatment, when the constitution is strong, and favored by good sanitary conditions, the chief reliance must be placed upon the destruction of the poison in the tissue affected. To accomplish this end, caustics of various kinds may be used, and although these will destroy tissues still living, the system finds no difficulty in throwing off such sloughs, while it rapidly improves.

This circumstance alone, is good evidence of the contagiousness of this special disease, for although by these measures we create gangrene on the spot, it loses its power of extension by the destruction of the poison. A great variety of agents have been employed to effect this end. In English practice, the actual and potential cautery, as well as nitric acid, have been favorites. In our own country, also, almost every form of caustic has been employed, but that which has afforded the most general satisfaction is bromine. Its cauterizing properties, however, are so mild that it can hardly be classed as a caustic. Disinfectants have also been extensively used, but to little purpose in their direct therapeutical results; they are, however, valuable for hygienic purposes.

Many surgeons in the employment of escharotics have failed to find the benefit which they have produced in the hands of others. This may be explained by the different methods of application. The author, for instance, has seen bromine employed upon the surface of these gangrenous sores, with no benefit whatever; but when it has been used in a thorough and peculiar manner, immediate and rapid relief has been obtained. Failure has thus usually been due to the imperfect and inefficient method of applying the remedy. Bromine, first brought to the attention of the profession by Dr. Goldsmith, possesses the property not only of being somewhat caustic, but also of changing from the liquid to the gaseous condition. If, therefore, rightly applied, it has a power of penetration possessed by scarcely any other substance. If the gangrene, for instance, affects the skin and the areolar tissue, no application upon the surface, unless it can destroy the slough itself, can reach the point of propagation. This is the border of the living tissue. In order to arrive at this, it is necessary that it should be cut, which, perhaps, is best done by etherizing the patient, and then dividing the areolar tissue with a pair of scissors beyond the line of the slough, so that the bromine can be introduced between it and the living part. The peculiar quality possessed by this fluid caustic, of sinking into water without readily mixing with it, enables us to control it with great ease. The sloughs having been dissected off, the bromine can be brought to the surface of the still living tissue, as well as thoroughly mixed with the gangrenous pulp on its surface. The method practised by Dr. Goldsmith, of thrusting the point of a small syringe into the bromine at the bottom of a vessel containing water, enables the surgeon to fill his instrument with the drug in its pure state. The nozzle of the syringe can be readily passed into all the nooks and corners of the sloughing wound. The injection of bromine by this method fills the whole pulpy mass, which is

immediately coagulated, and which can now be readily removed, being firmer in consistence, and more amenable to manipulation. This being once effectually done, is usually sufficient to arrest the progress of the disease. If it does not, the failure will be readily recognized by the continuance of the fetor, which disappears immediately when the work has been efficiently executed.

It must be obvious that such results as these are consistent only with the doctrine of local disease, and that any other methods of cauterization which can be applied to the surface and are sufficient to procure entire destruction of the dying tissue, will also secure a favorable result, and hence we find, from the beginning of any description of this disease, that while the constitutional symptoms have seemed to many surgeons to be the first expression of its invasion, they still have not failed to use escharotics of various kinds. Nitric acid, caustic potassa, and the actual cautery, are efficient enough, but are incapable of being applied as completely and safely as the mild escharotic, bromine, which rapidly passing from the liquid to the gaseous condition, presses itself into the tissues in a way that no other caustic does. When the stump of an amputated limb is attacked, the space between the muscles must also be treated in the same manner as the subcutaneous tissue. It is surprising how rapidly the constitutional symptoms subside, when these measures have been carried out as described ; a healthy, granulating surface appearing as soon as the slough is thrown off. Charcoal and yeast poultices, which have no efficiency in this form of gangrene, but which formerly had a good deal of reputation in all other varieties, might now be applied with some benefit ; and yet these have been largely superseded by lint saturated with Labarraque's solution, chlorine water, carbolic acid water (1 to 5 per cent. solution), and solutions of permanganate of potassium. Indeed, at this stage of the disease, disinfectants are hardly required.

The *constitutional treatment* must be according to that known as the supporting plan. There can be nothing that can claim the character of a specific for hospital gangrene. Opium is clearly indicated in consequence of the pain and restlessness of the patient, and, notwithstanding the anorexia, stimulants and tonics must be steadily administered. But constitutional remedies can only ameliorate symptoms; they cannot remove the disease.

For the prevention of the spread of hospital gangrene from one patient to others in the same ward, the most punctilious cleanliness is necessary. Sponges should not be used, unless burned immediately afterward, and the dressings removed from the diseased surfaces must be destroyed. The complete covering of a healthy wound with such materials as would protect it from the contact of contaminating substances, even when transmitted through the atmosphere, is urgently demanded. During our late war, syrups were spread upon the wounds, and sugar was also dusted on them, and these agents secured the desired ends very well; but perhaps the most efficient article of this kind which was employed, was the Peruvian balsam, the tenacious character of which made it a good shield. But long before this period, similar precautions had been used. M. Denonvilliers employed glycerine at the St. Louis Hospital with great advantage. He covered the wound with a fenestrated compress, spread with cerate and immersed in glycerine, over which charpie soaked in the same substance was also placed. He declares that the pain ceased almost immediately, and that the progress of the gangrene was arrested.

As far back as 1848 and 1849, Prof. Restelle treated four hundred cases of hospital gangrene in the military hospital of Alexandria, and had an experience which confirms the views herein expressed both with reference to the nature and the treatment of this

malady. Owing to the overcrowded state of the hospitals, no classification of the patients could be made. But this gave him an opportunity of observing that individuals suffering from contagious diseases, such as syphilis, were more easily affected with the gangrene, and that it rapidly produced in them dreadful ravages. " No general symptoms," he says, " usually preceded the alteration of character in the wounds." He also proved the contagious character of the disease by inoculating various wounds with the poisonous matter, and likewise by inserting it subcutaneously in healthy parts. He found, too, that amputations might be performed with safety if the patient was separated from those that were diseased with gangrene. After many experiments, he came to the conclusion that the best application was the solution of caustic potassa. On the first day he used the stick, endeavoring to penetrate the cavities of the wound. The next day the wound was dressed with a solution of one scruple to an ounce of water, and every day this caustic solution was rendered more weak until it was discontinued on the fifth day. By this plan, the worst cases were successfully treated.

It need hardly be said that to the direct therapeutical measures, an abundant supply of fresh air should be added. When this has been joined to complete isolation and cleanliness, a good constitution will often surmount the disease without the aid of therapeutics.

SENILE GANGRENE.

Senile gangrene (Plate IV., Fig. 1) has a name appropriate to its cause. Though not exclusively pertaining to senility, it occurs as an accident of conditions that supervene rarely but in old age. It clearly comes under the form of gangrene recognized as being due to arrest of circulation. Unlike the ligature, the cause operates slowly, but very surely. The incipiency of senile gangrene is so mild and apparently trifling to the uneducated eye, that unless painful, as it usually is, the attention of the surgeon is not at first called to it. A small dark spot, usually coming on the first or second toe, is soon followed by a vesicle containing dark serum. This, accompanied with loss of sensation at the affected point, and a decided lowering of the temperature of the foot, with a languid circulation, mark the commencement of this fatal disease. The patient is dying at the extremity. But although there is loss of sensibility at the exact point mentioned, even the early stage is generally marked by a moderate amount, and sometimes a great deal, of pain, both in the foot and limb. This also is usually aggravated by allowing the part to take the depending position. The progress of the disease is sometimes rapid, but ordinarily slow. The arrest of the circulation, from being partial, may suddenly become perfect, in consequence of a thrombus, and then the gangrene will reach the knee in a few days, terminating the life as moist gangrene. But this is only a sequence, and not the typical condition, which is that of slow extent, so much so as to frequently give the result of dry gangrene.

CAUSES AND COURSE OF SENILE GANGRENE.—That this disease is the sequence of rigidity of the arteries, admits of no question. The diminished supply of blood which arteries with osseous deposits in them must afford by the destruction or diminution of their elasticity, gives a satisfactory explanation of the primary cause of senile gangrene. There are, however, determining causes which, in consequence of some slight injury, set in motion the process which would probably have been warded off by proper care to a later period. Thus it has been observed that the development of gangrene is more likely to occur during the latter part of winter than at other periods of the year. Cases occur in which the disease becomes arrested, perhaps with the loss of the toes or a portion of the foot; and, warm weather coming on, cicatrization becomes perfect, the patient supposing that complete re-

covery has occurred. But the succeeding winter reproduces the old condition. Here the immediate cause is obviously the lower temperature in which the feet are kept except in the recumbent position, and when well covered. Whether indoors or outside, in the latitude of snow, the feet are in colder temperature than the remainder of the person. In rooms artificially warmed, the feet will be in an atmosphere from five to fifteen degrees (Fahr.) colder than that which surrounds the head. Besides, this depending position, ever subjecting the capillaries of the feet to the extra strain of gravity, assists in diminishing their nutrient capacity through their dilatation. The cell loses its ability to live, and, the fluid being extruded from the capillaries, a vesicle is formed. When this breaks, it will often be found that there is an excavation, the tissue having been destroyed so slowly that the cells have become fluid.

More often the destruction is too rapid for this. It progresses for a definite distance, perhaps to the junction of the toe with the foot, and then pausing, as if to stop at this point, encourages hopes of recovery. The toe becomes separated, and its tissue is broken down. But after a while a dark spot may appear on the skin above the point of separation. This spreads towards the original spot, and a new movement takes place, involving more tissue. Such pauses, however, are not the rule, which is rather one of slow but steady progress. Nevertheless, at times the disease is permanently stayed. The nutritive power of the circulation, which had become destroyed from the various causes above detailed, may become restored by their removal or palliation, and by care it may sometimes be maintained. The prognosis, however, is very unfavorable. It is not easy to recognize the bony deposits in the arteries of the inferior extremities. The tibials are only to be felt near the ankle, and may be free from disease at that point. Sometimes the destruction may be low enough to allow the red line to form, and amputation may produce a permanent cure; but more often the stump becomes gangrenous, and the disease goes on.

TREATMENT.—The treatment of senile gangrene obviously looks to the abatement of the cause, and inasmuch as this falls under the head of arrest of circulation, though imperfect, and as this primary cause cannot be removed, we must address our attention to those determining and relievable causes which the ordinary habits of life produce. Thus it is necessary that the patient should take the recumbent position, absolutely, for by this method the distension of the capillaries due to gravity, in the erect or even semi-erect posture, is removed. The recommendation to elevate the limb is to be condemned, as favoring a diminished circulation. Even the weight of the bed-clothes should be avoided. An absolutely even temperature of the surrounding atmosphere should be favored. No extra heat that would carry the warmth of the part above this should be permitted, though, in order to maintain it at the proper point, a little artificial heat may be demanded. The custom of swathing the foot in a mass of carded wool attains this object as perfectly as possible. A roll of cotton batting is usually more accessible, and perhaps as useful. In attempting to elevate the temperature artificially, care should be taken to prevent its rising above 100° Fahr., as too much heat distends the capillaries and makes the circulation languid.

Local applications are not of much value. Opiate washes to allay pain, are admissible, and should have the proper temperature on application. It is wise to inspect the foot as little as possible, so as not to vary the temperature. The charcoal poultice, so long in use for gangrenous conditions, is rarely employed in this special form of mortification. Its inconvenience overbalances the benefit derived. Cotton saturated in a solution of carbolic

acid, in proportion of one to twenty, has replaced it as a detergent and antiseptic.

The *internal remedies* required are only those directed to the maintenance of the general health and to the relief from suffering. Opium is obviously indicated, though it is difficult to believe that it possesses any specific power in promoting the capillary circulation, as has been asserted. That the secretions should be promoted when they become scanty, as is apt to be the case when nature is struggling with this disease, is an obvious dictate of common therapeutics. The constipating effects of the opiate should be counteracted, though cathartics are not indicated. Diuretics, such as the acetate or citrate of potassium, should be exhibited and continued until the high color of the urine disappears. The use of tonics, when the appetite wanes, is clearly proper; but no loading of the stomach with bark or quinine, as possessing specific properties in aiding the circulation, can be properly recommended.

Among the remedies that have been used to arrest the progress of senile gangrene, have been baths of oxygen gas, which it was hoped might maintain the vitality of the cell in the languid condition of the circulation. Two cases are on record in which a favorable result was obtained. But as the disease at times becomes spontaneously arrested, little confidence can be placed in a remedy that does not reach the cause. The practice certainly has not obtained currency. The use of warm water is as beneficial in this form of gangrene as in any other.

After the red line is well formed in senile gangrene, the removal of the limb is justified by its necessity, but seldom succeeds in its intent. The shock of the operation, added to the local irritation, usually results in recurrence in the flaps. Even when the stump heals, the succeeding winter is apt to re-establish the gangrenous condition. Nevertheless permanent results are sometimes obtained, and little else can be done. To choose the exact point of time when the most favorable condition for interference exists, will task the judgment of the surgeon. Before the slough separates, the depression from septicæmia is a forbidding circumstance. If we wait too long, the copious suppuration is a depressing cause, and delay is also accompanied with dangers from septicæmia. After the red line forms, there is usually an improvement of the general condition, which it would be desirable to take at its height for so serious an operation as amputation.

White Gangrene.

This is a rare condition, and there has been a little confusion among pathologists in regard to its definition. Rokitansky applies the term to the white appearance of sloughs, such as the denuded membranous expansions of subjacent tissues, and also to that of the sloughing peritoneum at the base of intestinal ulcers. Again, he says it is generated by the necrosis of textures replete with fibrino-croupous exudates. I cannot think that such conditions should receive this peculiar appellation. They do not require special classification. Their color is accidental, and not characteristic.

The true *white gangrene* is a special condition of great obscurity as regards its cause, and of great rarity. Very few surgeons have ever seen it, but the description of those who have, leaves no doubt of its peculiar character. By some authors it has been thought to be rather an incident of age, but this is decidedly erroneous. It is never a condition of senile gangrene. On the contrary, it appears in early adult life. The cause would seem to be constitutional, one attack being followed by others, and the intervals some-

times extending to months, though such cases also are exceptional. No dietetic cause is known, but the invasion of the disease is more apt to occur in the debilitated and ill-fed. An incursion of the affection is preceded by pains in the part, often of a decidedly neuralgic character, and, when in a limb, extending from the part to be attacked along the nerves leading to the trunk.

COURSE.—White gangrene may appear upon any part of the person, but it usually occurs on the extremities, and more often the lower ones. The neuralgic pains and depression may continue for weeks and even months before the occurrence of the gangrene. In females there are apt to be great menstrual irregularities and nervous symptoms. The gangrene at length shows itself by the formation of a circumscribed spot on the leg or foot, or it may include a toe. The color of this spot, which is generally an inch or two in diameter, with a tendency to become circular, is a dull white. The skin soon becomes dry, parchment-like, and somewhat shrivelled. This hue is retained throughout the whole time of separation, which takes place as in the case of other sloughs by the formation of the red line, the parts around having a reddish-purple color. A sulcus is formed, in which the process of granulation lifts off the slough.

There is in this condition a wide variety as to the depth of the slough. A very common form attacks merely the dermis, while another penetrates downwards through the tissues even to the bone. As might be inferred, the period of time occupied in the duration of the process may be very variable. If superficial, the white thin mass will drop off like an eschar in the course of two or three weeks; but when it goes to the bone, a period of months may be required for separation and repair.

DIAGNOSIS.—It is not possible to confound this condition with the gangrene arising from severe pressure upon the surface, nor with that resulting from contusion, for in both we have the skin and subjacent tissue immediately taking on a dark color. The white appearance caused by compression disappears in a short time after the pressure is removed, and, before it becomes gangrenous, the part acquires a deep red color. Where there is contusion, violet or gray spots appear from the beginning.

PROGNOSIS.—As regards the *prognosis* in white gangrene, it may be regarded as very favorable in the superficial form. But it must be also plain that when the disease passes down through the tissues, denuding the bones and opening the joints, it must be of a very fatal character.

TREATMENT.—The *treatment* of this disease does not differ from that proper in other forms of non-inflammatory gangrene at the same periods of life. There is the same depression of vital power during the progress and time of separation of the sloughs. For local application we may employ the disinfectant solutions employed in ordinary inflammatory gangrene. The constitution needs the same supporting plan.

SYMMETRICAL GANGRENE.

This condition is manifested in several ways. It frequently happens that both limbs become gangrenous almost at the same time, the disease extending upwards with a decidedly symmetrical movement. This may be due to the circumstance that both have deposits in the arteries in very nearly the same
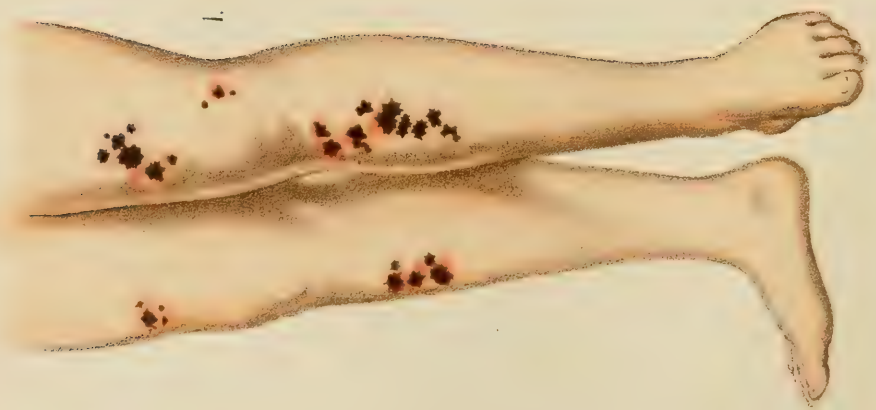
degree—a fact of common occurrence, and that when gangrene commences in one, the constitutional depression it produces is the determining cause of gangrene in the other. But this form of symmetrical gangrene may also be the result of embolism of the aorta at the iliac bifurcation, a cause which can be easily appreciated. There is, however, another form of the disease, not so easily understood, which is represented in Plate V. Fig. 1. The subject of this illustration became exceedingly ill with typhoid fever. At the point of extreme depression, sloughs of the skin began to appear, as indicated in the painting. No other cause than the fever could be assigned for their occurrence. I have known gangrenous spots to appear on the ball of the foot and upon the great toe, in a large man who consumed a great quantity of beer. The sloughs separated when he took the recumbent posture, and the parts healed perfectly. After a few days, however, the same condition appeared upon the ball of the other foot and great toe, and upon two toes adjoining. The sloughs upon the two feet were almost identical in form and size. The well-known condition of symmetrical disease, as manifested in rheumatism and eruptions, finds no exception in gangrene, though of rare occurrence. It is probably due to the differentiation of tissue so conspicuous in the skin and mucous membrane. Local gangrene, common enough in typhoid fever, was, in the case above mentioned, obviously determined as to its position by the differentiation of tissue in the skin.

Diabetic Gangrene.

Diabetes is a condition which produces such a depravation of the fluids as to interfere with the nutrition of the cell. When there is any depressing local cause, such as a traumatic one, the gangrenous process will sometimes arise. But the most common manifestation of this process is to be found in the production of carbuncles and boils. We can only offer for its relief the special treatment of diabetes, combined with the local treatment of moist gangrene.

Diphtheritic Gangrene.

Diphtheria presents itself readily upon abraded surfaces, as well as upon the mucous membranes, though not so readily in its inception. But after the operation of tracheotomy, practised for its relief, the exudates extend over the surface of the wound as well as upon the mucous membrane. In consequence of a certain resemblance, diphtheritic has been confounded with hospital gangrene, and there is undoubtedly a similarity in the appearance of the exudate. But the theory of their identity receives its refutation from the fact, that the prevalence of diphtheria does not result in the gangrene of sores in the neighborhood of diphtheritic subjects, and that, on the other hand, the existence of hospital gangrene does not produce diphtheria. The occasional concurrence of the two conditions is exceptional. These two forms of gangrene are like each other in that, in both, the exudate decomposes with a fetid odor; but the process of sloughing is slower in diphtheria, though the blood invasion is quite as rapid.

Cause of Diphtheritic Gangrene.—The question whether microscopic fungi are a cause of gangrene, and especially of the diphtheritic form, has received a great deal of study, and never so much as quite recently. The labors of Formad, Sternberg, Satterthwaite, Curtis, and others in this country, not to mention the host of European observers who commenced this inquiry fifteen years ago, point with great clearness to the existence of micrococci as

constant phenomena in the part affected, and usually in the blood and urine when the attack of diphtheria is severe. But it is also known that these same forms are present on the tongue without gangrene, and do not differ from those found in the blood after this condition has supervened. It is true, doubts of the existence of these minute forms have been entertained, but the testimony of competent observers is uniform in affirming their presence. Still, until we find that the forms which are met with in different diseases are distinct, we must regard their presence as secondary, and not as primary causes. These remarks apply to the existence of the so-called micrococci: it is well known that bacteria of various kinds do exist in the decomposing exudates, either gangrenous or purulent, and, indeed, are the constant concomitants of decomposition. The experiments of Koch, on mice, connected the presence of micrococci very distinctly with the necrotic process, without the presence of diphtheritic exudates. Indeed, the inoculations were made with gangrenous fluids, and not with diphtheritic membrane. But it is impossible to separate these forms from the fluid in which they exist. The question of cause and effect still remains open. Nevertheless it is urged that the blood corpuscles are invaded with the minute forms which fill them, and appear to live upon their substance, attaining at maturity the magnitude of a thirty-thousandth of an inch. If, however, these are to be seen in the healthy person, upon the tongue, one can hardly avoid looking for another cause, still antecedent, which may foster them and permit them to proceed deep into the tissues—assisting and, indeed, completing the destructive process, but not themselves its source and origin.

TREATMENT.—The treatment of this condition, when on the surface of wounds, is not different from that proper for hospital gangrene. It must be thorough to be efficient. If a portion is left untouched, the disease is renewed upon the same surface.

BEDSORES.

These painful and dangerous sores (Plate V. Fig. 2) occur far more readily in some persons than in others. The direct cause is too constant pressure upon a given point. But this is also aggravated by special conditions. If the patient is thin and emaciated by long-continued suppuration, the bones have a power of pressure which they would otherwise not possess. In such persons, every point thus exposed will take on, in the first place, a low grade of inflammation, with a reddish-purple color of the skin, and a tendency to grow darker as the disease advances. The skin losing its vitality, an ulcer is usually formed, at first small, and over the point of greatest pressure. But as the process of destruction goes on, a slough is formed, which extends inwards to the periosteum, or to the fascia investing the muscle, which also gives way if the pressure is continued.

The most common sites for this form of gangrene are the sacrum and great trochanters, but it will appear at any point where the pressure is sufficient. It is also more readily produced in persons who are paralyzed; for this condition is apt to render the pressure more constant and absolute, while the circulation becomes more languid. It is also especially liable to occur in persons who have become feeble in consequence of some wasting sickness, or who have an exceedingly painful joint, as the knee or hip, that compels absolute quiescence. Such patients are also often afflicted with incontinence of urine. The skin and subcutaneous tissue yield with wonderful facility, and the sore, which at first was a mere point, rapidly extends so as to uncover the whole

sacrum, and lay bare the trochanters and the crest of the ilium. The addition of these sloughs as a complication to any other sickness, is very apt to become the determining cause of a fatal result, and hence they must be guarded against with most scrupulous care.

Treatment of Bedsores.—The cause of bedsores, which consists chiefly in pressure, is very difficult to remove, and yet, even at the expense of injury done to other sickness that may be present, this must be carefully done as far as possible. Frequent change of position, so as to relieve the suffering points for a portion of the time, is one of the most efficient methods of prevention, and is almost sure to accomplish its object when the change can be made permanent.

The surfaces, before becoming abraded, may be covered with soft leather, such as chamois skin, spread with emplastrum saponis, or with unirritating poultices; but the latter have little efficiency, and are difficult of application. Rings of cotton-cloth, stuffed with hair, cotton, or wool, of such a size as to bring the pressure outside of the suffering point, should be carefully adjusted.

It is surprising with what rapidity these unhealthy surfaces will take on the process of repair, when the pressure is entirely removed. They seem to possess none of the peculiar power of hospital gangrene for self-propagation. They are simply traumatic. When the surfaces have once become broken, there is no better treatment than to dress them in the way described, although this is attended with some inconvenience at the points where these sores are apt to occur. A ring of the kind mentioned may have a poultice placed across its opening, and thus be made to present to the sore the softest bed for it to lie on. Rings of India-rubber and air-cushions are used,[1] but are, in my estimation, inferior to the simple ones described above, which it is needless to say should never be used a second time. But such measures must not take the place of frequent change of position, and it is surprising how much benefit may be obtained by simply rolling the patient upon the sheet from one side to the other every hour, even for a short distance. Where the presence of the urine cannot be avoided, much benefit will result from the constant use of unirritating unguents, such as simple cerate, oil, or vaseline. When there is fear that an ulcer may be established, it is useful to bathe the surface affected with water acidulated with vinegar, or with lemon-juice, and thus to neutralize the alkalinity of the moist exudates. Prof. Billroth prefers a hair mattress for the patient to lie on, and it must be confessed that this is superior to most others, but the water-bed of Arnott should claim the preference. Unfortunately, this is rarely accessible. The continuous bath, kept constantly at a temperature a little above 100° Fahr., has been used with excellent effect, the body being suspended in water by bands above and below the sore. The inconvenience of the plan must be its principal objection. No better treatment for the sloughing ulcer could be devised, except the entire removal of pressure which in most cases cannot be effected.

It is often observed that bedsores present, at the same time, a tendency to heal at one portion of their surface, while sloughing is going on at another. This is due to the change of position, and is illustrated in Plate V. Fig. 2, which represents a large surface denuded upon the sacrum and hips of a young girl of feeble intellect, who was dying of consumption, and who allowed her urine to pass into the bed.

I must not fail to call attention to a condition of so-called bedsores among the insane, which are to be distinguished from those described above by the

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[1] Purfoi urges the use of a beef's bladder, partially distended with air, to be placed on the part.

rapidity of their formation, and by their occurring on parts of the body not subjected to constant pressure. They commence by redness over a circular area, but with feeble circulation, and, the skin dying, a hard black patch is formed. In a few days this sloughs out, and the cavity is slowly filled with granulations. The *treatment* consists in the adoption of a stimulating plan, both general and local.

NOMA.

This disease is peculiar to young children, usually attacking the mouth, and appearing in the first place upon the pro-labium or upon the mucous membrane of the cheek. In this form it is commonly known as *Cancrum Oris*. Its first symptom is the appearance of a vesicle, which seems to result from a peculiar poison developed in this highly vascular part of the body. But it is also to be found arising upon the pudenda of female children. It is apt to follow measles, scarlet fever, and other cachectic conditions, but often arises spontaneously without these special antecedents.

An account of the disease, as affecting the *pudenda*, by Mr. Kinder Wood,[1] describes it as commencing with a chill, followed by high fever, pain in the head, dulness, unusual loss of appetite, and thirst, the tongue being coated, the bowels torpid, and the patient languid and restless. These symptoms precede the local manifestations about three days. The inflammation of the labia produces great enlargement, accompanied with a dark tint, extending to the clitoris, nymphæ, and hymen. It probably also extends to the lining membrane of the urethra, for the pain in voiding urine is excruciating. The progress of the inflammation is so rapid, that small ulcers are formed in twenty-four hours, and soon run together. The disease now extends along the perineum to the anus, and to the inner part of the top of the thigh, and also even over the mons veneris, with deep sloughing and ulceration. The constitutional symptoms are those of prostration; the pulse is quick and irritable, and the face of a peculiar pale hue, the skin exhibiting a singular whiteness, which seems to be always present after the ulcerations have formed. The pain upon moving the pelvis is excruciating; hence the patient takes the recumbent position, with the legs bent and the knees separated. The motion of the bowels and the passing of urine are resisted to the last moment, in consequence of the severity of the pain. The period of time occupied in the progress of the disease is not uniform. When it proves fatal, the external organs of generation are progressively destroyed, and the pulse becomes more feeble. The emaciation is rapid, so that the skin of the thighs is loose and flabby, as in marasmus. If the patient recovers, it is but slowly, for the constitution is much debilitated; a copious, yellowish, mucous discharge is kept up for a period of many weeks. Post-mortem examination gives no evidence of any inflammation within the abdominal cavity, the patient dying obviously from septicæmia.

But the usual seat of noma is in the *mouth*. The author has seen a few cases, but will present one detailed by Sir James Paget, as a good illustration of the fatal progress of the disease:—

Edward F., an emaciated child, aged five and a half, was admitted to the hospital on January 25, 1862. About Christmas he was said to have been laid up by typhoid fever, but with no eruption, sore throat, or diarrhœa. He was very deaf, much prostrated, and never fairly recovered his health. Three weeks ago he lost his appetite, and appeared to be generally unwell, but found no difficulty in eating or swallowing. Seven days ago, his mother noticed some blood about the teeth and lips, and observing the

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[1] Medico-Chirurgical Transactions, vol. vii. p. 84. London, 1816.

cheek to be swollen, she looked into the mouth, finding what she thought to be a " gum-boil on the cheek, discharging." Still, he did not complain of pain, and took a fair quantity of food. The swelling continued rapidly, increasing all the week, but the black-patch appeared only yesterday evening. Fomentations to the outside and lotions to the inside of the cheek had been prescribed. All this time he had had little sleep, and was constantly delirious.

Jan. 25.—He was lying on his right side, breathing hurriedly. He was very sullen, and his eyes were surrounded by dark areolæ, while the face was distorted by an enormous swelling of the left cheek and part of the lip. The outer angle of the mouth, half of each of the lips, and a portion of the left cheek, were occupied by a black slough, terminated by a well-marked line, and apparently suppurating in portions of its circumference. The skin around was very tense and tender, the sore having a very offensive odor. Inside the mouth there was the same black slough, but not quite as large as that on the cheek, and apparently not involving the gums. These symptoms continued, with slight aggravation, the child dying on the afternoon of the 28th, having refused all nourishment during the day.

TREATMENT.—The therapeutics of noma can hardly be said to have a specific character. The disease does not exist except in the anæmic, and especially in those who are so from bad and insufficient food. It may be doubted if it often occurs, except in the dwellings of the poor, and amid the worst sanitary conditions. There must be a change in these respects ; good air and diet are the initial steps in treatment. Tonics of quinine and iron are beneficial, but the chief reliance must be upon a milk diet with beef-tea and stimulants. The *local treatment* is best carried out with washes of chlorate of potassium, and careful detachment of the sloughs. The tendency to a fatal result is very great, and no amount of care will always arrest the extension of the disease to the bones of the face.

This pathological condition is said to be marked by the presence of bacteroid particles moving actively in the blood and other fluids. These are said to have special characters, and to possess the faculty of virulent infectiveness.

A case reported by Dr. Sansom presented a large number of small, highly refractile bodies, seen in active movement, which resembled minute, colorless crystals. Their motion was usually rectilinear, and sometimes in opposition to the current of the blood. Two or three attached to a red corpuscle were observed distinctly to move the latter. The number of these mobile bodies varied greatly at different times. Their size was about the twentieth part of that of a red corpuscle. Shortly before the fatal issue, ordinary bacteria were observed in addition to these translucent bodies. The red blood-corpuscles presented great variations in size. Translucent bodies, exactly resembling those observed in the blood, were found in the urine immediately after it had been voided, and a large number were seen in the feces. The discharges from the wound also manifested them in abundance, intermingled with the usual organisms which accompany putrefaction. Experiments upon a mouse and a Guinea-pig, made by inoculating them with the blood of the diseased person, resulted in the production of intense cellulitis of the abdominal wall about the site of inoculation, and also in peritonitis. The special translucent bodies were also found in large numbers in the blood. Further observation, however, is necessary, to show these to be constant phenomena in cases of noma.

There is a slough, happily not made as often as formerly, due to mercurialization, which closely resembles noma. In the latter, however, the slough will usually extend to the whole thickness of the cheek, while in the mercurial affection it seldom destroys more than the inner surface ; moreover, this has not the fatality of noma, and, when healing, is apt to draw the lower jaw into close apposition with the upper by the contraction of a large cicatrix.

[The editor's experience leads him to believe, with Mr. Holmes, that the most important point in the treatment of noma is early and thorough cauterization with nitric acid, or, which is sometimes preferable, the acid nitrate of mercury. Iodoform is useful as an after-dressing.]

ERGOTISM.

This form of gangrene, referred to by the older writers, seems to have passed away from modern observation, and, in view of the very free use of ergot at the present time without the results heretofore described, there may be a serious doubt as to whether the disease was not largely due to the straitened and impoverished condition of the patients who had taken the ergotized rye and wheat. Nevertheless, the descriptions that have been given us seem to point to this as the determining cause of the gangrene.

Looked upon during the middle ages as a miraculous punishment, directly inflicted by the hand of the Deity, the first accurate account of this affection seems to have been that given by the Professors of the Marburg Medical Faculty, in 1597; but from that time the malady appeared at different intervals, and prevailed extensively in Europe, causing, as is said, sometimes only spasmodic affections, but oftener gangrene of the extremities. It was well described by Langius as occurring in some counties of Switzerland, in 1715 and 1716:—

"After excessive lassitude," he says, "more or less protracted, and unaccompanied with fever, the extremities became painful, cold, and rigid. Benumbed and almost insensible, the limbs were yet capable of movement, though with difficulty. There was great pain, which was increased by heat, but abated somewhat upon exposure to a cooler temperature. Pain extended by degrees from the toes to the legs and thighs, from the fingers to the arms and shoulders, until, sphacelus supervening, the affected parts, dead and black, dropped from the trunk or the adjacent members. Remarkable as it may appear, the general health appeared to be but little affected, with the exception of slight febrile heat, increase of pain, and copious perspiration. Those with whose food ergot had been sparingly mixed were only affected with a sense of weight in the head, and drowsiness, sometimes followed by transient intoxication."

A very fatal epidemic of this kind raged in Solognes in 1747. Vetillart, in 1770, gave the following example of its virulence:—

"A poor man of Noyen, in Maine, seeing a farmer sifting his rye, begged the refuse to make bread with. The farmer cautioned him as to the danger of using it, but hunger prevailed over fear. The siftings, composed chiefly of ergot, were ground and made into bread. In the space of a month the poor man, his wife, and two of his children perished miserably. The third, an infant at the breast, who had eaten panada made with this flour, escaped death, but was deprived of both legs, and became deaf and dumb."

A spasmodic form of this disease was described, as it existed in districts of Bohemia in 1736, by Scrinc, who declared that he had seen about five hundred cases.

He described it as commencing with a sense of tingling or itching in the feet, followed by severe cardialgia. A tingling sensation, compared to the bites of ants, was followed by violent contractions of the hands and feet, affecting each particular joint, and resembling the pain of dislocation. The patients complained that the hands and feet were burned, the body being bathed in copious sweats. After these pains—which were intermittent, having sometimes intervals of two or three days—the sufferers were affected with drowsiness, giddiness, and indistinctness of vision, and staggered in walking. Some became maniacal, some melancholy, and others comatose. Those beyond the age of puberty were liable to epilepsy, and died. An enormous appetite generally accompanied this train of evils. In one case, spots appeared on the feet, resembling the bites of flies, and remained to the end of the eighth week. The faces of many were extensively covered with these spots. In those who recovered, the disease rarely abated before the third week, while in many it continued for one or two months.

Dr. Wollaston, in 1762, described the attack of a family, composed of husband, wife, and six children, all of whom were affected by this disease.

The oldest child was a girl of fifteen, and the youngest an infant four months old. They were all healthy at the time of the attack. It commenced with severe pain, which in most of the cases affected the left leg first—a pain so violent that the cries of the sufferers alarmed the neighborhood. In the course of a few hours the toes became much swollen, and after four or five days the pains abated; the feet were covered with spots of purpura, and then became black. In some, the sound limbs became diseased; all, with a single exception, were affected about the same time, in the month of January, the weather then being warmer than usual. In the case of the father, the disease assumed the milder form, the fingers only becoming discolored and contracted, and several of the nails falling off. For a long time afterwards he continued to complain of darting pains in the limbs, knees, arms, and back. During the whole time of this calamity, the family appeared in other respects well. They ate heartily and slept soundly when the pains abated. At the termination of the disease, the father had recovered, except as to two fingers, which remained to some degree contracted; the mother, aged forty, had lost the right foot at the ankle-joint, and the left leg a little below the knee, her hands and part of her arms remaining with but little sensation, the fingers being also contracted; Mary, aged fifteen, had lost both legs below the knee, and was then dead; Elizabeth, aged thirteen, had also lost both legs below the knee; Sarah, aged ten, was deprived of one foot and two toes of the remaining foot; Robert, aged eight, had both legs off below the knee; and Edward, aged four, had lost both feet at the ankle-joint. The infant had been weaned as soon as the mother was attacked, but became ill, and died in the course of a few weeks. It appeared to suffer violent pain, and the legs became black before death.

Dr. Wollaston states that, with the exception of the mother, the family seemed well—one poor boy in particular looking as healthy as possible, sitting on the bed, quite jolly, and drumming with his stumps. No cause could be assigned for this terrible visitation, except that the family had lived for about a fortnight on bread made from wheat which had been damaged at harvest. It had been cut in a rainy season, and had lain on the ground until many of the grains were black and totally decayed. These were undoubtedly affected with ergot.

The only reasonable treatment of such an affection would seem to be the use of good food, and the adoption of the supporting plan. Generally, of course, amputation after the formation of the red line would be proper, as in some other forms of gangrene. Those affected only with spasmodic contractions should be treated with tonics and anti-spasmodics.

Gangrene from Embolism.

Embolism is a term given to the arrest of the arterial circulation by a fibrinous plug or *embolon*. This embolon is usually, and almost necessarily, a fibrinous heart-clot, but may also be the result of vegetative growth in the systemic circulation, or in the course of the pulmonary arteries or the portal veins. The belief that obstructions of this kind might exist in the circulation was entertained long before the true mechanism of embolism was discovered. Galen recognized the existence in the heart of "polypi," which he believed interfered with the movement of the normal spirits, and thus resulted in death. Vesalius also observed a coincidence between gangrene of the extremities and disease of the heart. But after the discoveries of Harvey, affections of the circulation attracted extraordinary attention, and these "polypi" were regarded as prolific causes of disease. Bonetus, in the sixteenth century, recognized the difference between clots formed during the moribund condition and those that had existed during life. As he says: "These last are white, firm, rich in fibrin, while the recent are red and soft"— differences which we still recognize to-day. Van Swieten made the first

direct experiments upon this subject, by injecting pure alcohol into the crural vein of a dog, and thus producing a thrombus which passed into the pulmonary artery, and "there," as he says, "became fixed, and occasioned great anxiety, convulsive efforts of breathing, and rapid death." Later surgeons regarded clot as evidence of arteritis.

But it is to Virchow that we owe the recognition of thrombosis in its connection with embolism, which, although recognized in the minds of observers in a vague way, for a long time, did not receive its full and scientific explanation until it was given by this writer. Long before Virchow's experiments, however, Cruveilhier, in his admirable work on Pathological Anatomy, had maintained the doctrine of capillary phlebitis, and had connected the occurrence of abscesses in the lungs and other organs with the existence of pus in the veins. But Virchow's experiments tended to show that the apparent phlebitis was more often the sequence of thrombosis. That a thrombus should be formed is now easy for us to understand, for although the lining membrane of the vein possesses in its normal condition the ability to preserve the blood in its fluid state, by virtue, probably, of some special power of its own, the causes that may interfere with this condition are very numerous. The condition of inflammation itself, occurring upon the external surface of the vein, may extend through its coats, and in this way produce a tendency towards an exudation upon the lining membrane. Moreover, the epithelial covering may be removed, and then we have an abraded surface, well known to be favorable for the production of fibrinous accumulation and thrombus. Whenever this happens, there is repeated upon the surface of the vein the well-known experiment of the chemist, who collects his fibrin from the mass of blood by "whipping" it with twigs which present points for coagulation.

A clot thus formed in a vein may become detached, and, floating in the circulation, may go into larger and larger trunks, until it reaches the right side of the heart, after passing through which it enters the pulmonary artery, and goes on until it is arrested in its progress by the diminishing size of the vessels. Then we have an embolon or plug in a branch of the pulmonary artery, and at once a section of the lung has its function arrested. But the causes that may produce coagulation in the veins are very numerous. Every surgeon has seen coagula thrown out from a vein when incising a hemorrhoid. A coagulum is also formed where a vein is tied—and one, too, that moves easily from its attachments. To the above causes of thrombus we may add wounds of the veins, as from points of bone in cases of fracture, from phlebotomy, etc.

A thrombus once formed, need not necessarily be detached. It may give rise to further coagulation until the whole vein is filled with a firm clot, which may, by its presence, become a cause of local inflammation. Uniting with the venous coats, if it does not inflame them, it may at length, according to the opinion of Billroth, become partly organized and partly absorbed, converting the vein into a cord.

The clot that concerns the surgeon, however, is usually formed in the heart or arteries. It is easy to recognize its mode of development. The irregularity of the valves of the *heart*, and the frequency of their alteration in disease, producing changes in their shape, and also developing vegetations upon their surface, favor the production of coagula, which, becoming detached, pass at once into the systemic circulation. These vegetations may thus be broken off, and after being lodged may become a nidus for further coagulation. I have seen such a growth, arising from the surface of the heart half an inch below the aortic opening; the rhythmical movement gradually drew it out, so as to form a pedicle, and aided a fibrinous increase.

An unusual motion of the heart suddenly drove it into the mouth of the aorta, where it was found, having produced instant death.

The walls of the *arteries* of the extremities, and indeed throughout the whole system, are liable to atheromatous deposits, when the irregular points which they present may become the means of separating the fibrin, and of thus forming a plug which may close the vessel at the point of its origin, or may be broken off and swept along to its place of final lodgment. Besides these causes, there are occasionally tumors and growths external to the artery, which by occluding its calibre and perhaps causing, by the increased flow of blood at the point, an abrasion of the epithelial surface, produce fibrinous clots.

In studying the movements of the embolon in the aortic system, we find that it follows the direction of the principal trunk, and that it is rarely lodged in a vessel which passes off at right angles. For this reason, it is seldom found in the carotids, but reaches arteries below, especially the iliacs and their branches.

That embolism should produce a different result in the large and small arteries, is not to be wondered at, and it is found that its results are in fact various. If in a large artery, and if the plugging is complete, the condition is identical with that produced by a ligature, and is marked by similar signs. But it often happens that the obliteration is incomplete, and that a certain quantity of blood passes through the vessel, the circulation being diminished, but not entirely arrested. Hence opportunity will be given for the development of anastomosing branches, and although the plug may afterwards enlarge so as to entirely occlude the vessel, the circulation beyond may be restored. A *sudden* closure at the same point might result in gangrene.

In addition to these primary emboli, we have those which are secondary. The new formation is susceptible of disintegration, and then particles of a smaller size are carried further along in the circulation, playing their special rôle in the production of infarctions, and still further taking on the character of cicatricial tissue, or exciting inflammation which develops into abscess. This is indeed the explanation offered by some pathologists of "metastatic abscesses." When we consider the action of these smaller clots in closing up minute vessels, we are led to believe that the cell ceases to live, and may undergo a double change. If protected from atmospheric influence, it is simply removed by absorption, and the tissue formerly supplied by these closed vessels takes on a semi-cicatricial character. Such spots of contracted tissue are found in the liver, spleen, and kidneys, and may be fairly attributed to the process described. Or it may excite the inflammatory process, which now produces exudates with all their consequences.

It is undoubtedly true that clots are far more likely to enter the circulation in the veins than in the arteries, and we might infer that the injury from such clots might fall exclusively upon either the liver or the lungs by the arrest of the emboli in their capillaries. But the arterial circulation is by no means protected by the capillary systems of these great organs. Minute clots will pass through them, and enter the arteries, where they may grow by accretion; or they may undergo fatty degeneration or be redissolved, and entirely disappear. It is perhaps impossible to make a positive diagnosis during life of embolism in the smaller vessels.

Fat Embolism.—There is also a form of embolism arising from oil globules which, passing into the circulation, become entangled in the capillaries of the lungs, which may be considered as not only established by observation, but confirmed by direct experiment upon animals. The sudden death that sometimes follows fracture, especially of the neck of the thigh-bone, may be

traced to fatty embolism. When the quantity is not large, we may have merely an inflammation from this cause.

SYMPTOMS OF EMBOLISM.—The symptoms that mark the occurrence of embolism may be stated to be, in general terms, a suspension or modification of the function of the part. When in the extremities, the arrest of the circulation is instantaneous; the surface becomes pale and cool, and while a certain numbness is found in the skin, the pain is severe and intractable. The progress of the ensuing gangrene is not uniform—sometimes slow, but at other times rapid. I recall a case that went on to the destruction of finger after finger, the loss of tissue being arrested for a while, a red line forming, and giving delusive hopes of final cure, but the disease going on in this way again and again. Sloughs were removed, and the parts amputated at the points indicated by nature, but the gangrene was still renewed, and recovery was only obtained by amputation at the shoulder-joint. In another case of embolism following pneumonia, with gangrene occurring in the leg, the red line was but imperfectly formed at the end of three months. Amputation was performed at this time, but death occurred at the end of six days. This very slow progress is not characteristic of gangrene from embolism; it is more often rapid.

TREATMENT.—If certainty of the exact point where the arrest occurs could be obtained, immediate amputation would be clearly indicated, as in cases of rapid traumatic gangrene. But this may be regarded as impossible, and we are necessarily relegated to the rule of waiting for the red line, and of not hastening the operation until we see clearly nature's intent. During this painful waiting, we certainly have few resources. The principal indication is to maintain the temperature, as in senile gangrene. Warm applications, a little above the normal heat, are employed; they should be dry, as cotton and wool. But the experience of relief, on the part of the patient, is the surest guide. In the case of the arm, above mentioned, the patient found flannels heated far above this standard the most comfortable. Of course, the removal of sloughs not touching the living tissue is clearly indicated. Disinfectants must be employed, for the comfort of the patient.

FURUNCLE OR BOIL.

This small but painful inflammation of the skin, of which almost every one has some personal experience, rapidly forms a slough, unless aborted in its very earliest stages. The exact initial point at which the inflammation commences is still *sub judice*, while there is good reason to believe that it may be in the sebaceous glands. This opinion derives some color from the fact stated below with reference to superficial irritations as a cause.

SYMPTOMS.—The first evidence of the existence of a furuncle is shown by a small point of inflammation, which produces a hardness underneath the surface of the skin, feeling somewhat the size of a small pea. This gradually increases with a rapidity a little different in different constitutions, but seldom acquiring a size greater than half or three-quarters of an inch when at its height. This terminates in a small slough, saturated with pus, usually of a greenish-yellow color. An opening, through which the pus makes its way, takes place in the skin, as the result of the pressure, small, brown, and an eighth of an inch in diameter. During the first stages, while the destructive process is going on, and before the evacuation of pus through this minute opening, the pain, tenderness, and soreness are so characteristic as to

be typical of inflammation accompanied with suppuration; "sore as a boil" seems to convey, through general experience, accurate information of this peculiar and distressing sensation. The hardness of the tissue around about, which produces so much pain and heat, is due to the rapidity with which the exudation occurs. After the opening has taken place, the pain, which is throbbing, and especially severe in consequence of the density of the tissue, rapidly subsides; this is due to the relief obtained from pressure. The edge of the opening develops, however, an extraordinary tenderness to touch. The part below has undergone the gangrenous process, and the resiliency of the distended tissue presses upon the slough, which becomes gradually extruded through the opening. The slough has been thought by no less an authority than Rokitansky to be merely an exudate, but this opinion may be put down as decidedly erroneous. It is composed of connective tissue, filled with fibrin and pus.

It occasionally happens that an inflammation begins in the skin, which resembles the one just described in its early stages, except that it goes on slowly and does not suppurate. This is known in common language as a " blind boil," and is probably an inflammation at the same point, but of low degree, and capable of undergoing resolution. The form that the skin takes on in the ordinary boil is that of a cone, and the opening is at its apex. In this respect it differs from the carbuncle, which even in its early stage is spread out and somewhat flattened, though the latter peculiarity is more marked after the disease is fully developed. I have elsewhere stated a disbelief in the doctrine which regards these two conditions—furuncle and carbuncle—as identical, and as differing only in degree.

The *constitutional symptoms* are slight, unless there be a great number of boils upon the person at the same time, a condition of rare occurrence. There is a slight appreciable febrile movement, hardly to be measured by rise of temperature or increased frequency of pulse, but recognized by the nervous system in producing a little languor. Boils sometimes appear in great numbers upon the same person, but usually not at the same time. Individuals develop what may be termed a "furuncular diathesis," so that they will be scarcely free from the existence of these painful torments for months and years. In such persons we recognize a depravation of the fluids, but chemistry has not thus far taught us in what this consists. The condition which predisposes to boils is often connected with a special change of habits; the more violent the alteration of diet and regimen, the more likely are boils to occur. I have several times been able to connect a very large use of sugar with the eruption of these painful inflammations. The evidence of this was found in their cessation when this special regimen was abandoned.

Causes of Furuncle.—Like carbuncles, and, indeed, all other inflammations, variations of climate and special years will be accompanied with greater or less manifestations of the disease. But there are local causes which every practising surgeon must have recognized. The application of poultices, and especially the covering of surfaces with cold water lotions kept up for a considerable time, are apt to be accompanied with an eruption of boils. These are also seen to rise up in numbers upon a surface that has been blistered by cantharides, and the author has frequently been a victim to their painful presence upon his hands after dealing with sloughing tissue. Boils occur over the surface of the body in a more general manner than carbuncles. They seem to come upon parts that are specially fretted; hence, one of the most favorite places for their appearance is upon the nates. In common with carbuncle, however, they seem to have a tendency to appear upon the nape of the neck. This may be attributed to the constant fretting of this part of the

body by the clothing. The pain is largely to be measured by the density of the skin at the particular point where they occur. After the period of puberty there does not seem to be much difference in the frequency of their occurrence, but they are very rare in quite young children. They show themselves, however, in the years that just antedate puberty.

TREATMENT.—The treatment of a single boil will be almost uniformly merely local, and may be said to be purely expectant. For although we usually cover the surface with warm poultices, these do little else than protect the part against external injury. The notion that suppuration is materially accelerated by the use of these cataplasms can hardly be sustained. Nevertheless, the pain and soreness are materially diminished by the frequent renewal of a warm or even hot poultice. The inconvenience, however, of the application is sufficient to cause it to be laid aside for other plans. The most convenient of these is some smooth unirritating plaster, such as adhesive or soap-plaster, smoothly spread, which merely protects the surface against the friction of the clothing. It is customary to practise incisions to hasten the cure, but if made at the wrong time they fail of their object, and may be regarded as a surgical operation the pain of which is out of proportion to the benefit received. When suppuration is well established, and the skin opened, nature separates the slough more perfectly by a little delay. If the incision is made after the formation of the slough is begun, it has the effect of prolonging the separation, which we know must of course take place. The "core" can be assisted in its extrusion by a little gentle traction. It is sometimes said that a boil can be aborted by the use of counter-irritation in the neighborhood, as for instance by the painting of iodine in a circle of three or four inches in diameter around the central point. But there can be no question that incisions practised early are adequate to this end. The cuts should be crucial, so as to take off the tension at the central point—thus abating the inflammation and preventing gangrene. For the treatment of a single boil this is seldom likely to be resorted to. The invasion is too insidious to induce the sufferer to apply in time. But when a patient is suffering from a constant succession of these painful annoyances, he is quite willing to obtain relief through this surgical remedy, which is far less painful than when practised upon the boil in its ripe condition. Indeed, the operation can be so easily rendered painless by the ether-spray, or by momentary freezing with salt and ice, that it may be regarded as not only the best, but an easy method of giving ease. The initial step in the development of the inflammation is readily recognized by those who are suffering from furuncles, and advantage may be taken of an early diagnosis.

The *constitutional treatment* has really no application except in those cases in which a constant succession of boils exists, and in such patients we are to be governed by the rule of rectifying any known cause of ill-health. But we shall often find some slight constitutional disturbance, perhaps of a dyspeptic character, with furred tongue, and urine slightly heightened in color. In such a condition, a laxative and diuretic are clearly indicated. It has also been found, especially in malarial countries, that quinia, or its equivalent in bark, is required. Proper regard for diet and regimen, in order to secure restoration of high health, needs neither enforcement nor elucidation.

Like the carbuncle, boils have been found associated with the presence of diabetes. John Hunter, who suffered from a crop of boils for many months, thought himself relieved at last by the persistent use of the bicarbonate of sodium. But inasmuch as the dyspeptic condition is the determining cause of the disease, it is obvious that there will be cases that will be relieved by

acids as well as others benefited by alkalies. It is therefore clear that no specific has thus far been discovered adequate to the relief of the condition known as "furunculosis."

ANTHRAX OR CARBUNCLE.

This inflammation is recognized by the peculiar form which seems to prove its specific character. Commencing in the lower layers of the cutaneous tissue, it puts on at first the appearance of a phlegmon, but is not accompanied by the bright redness of this form of inflammation. It is a little rounded during its early stages, and shows a tendency at this period to the production of vesicles on its surface, but after being thoroughly formed it is flat, and raised above the adjoining parts like a table land, this feature being especially marked if the carbuncle is large. All doubts with reference to the character of the inflammation are settled by a careful inspection of the surface, which exhibits a tendency to suppuration around the roots of the lanugo hairs. As the disease progresses, numerous points of suppuration appear, and some will be found more advanced than others. I have counted upon a small carbuncle, a little less than an inch in diameter, thirty-four of these purulent points, and in the centre of each a lanugo hair could be distinguished. As will be readily seen, such a condition does not obtain with a furuncle, nor with a phlegmon. The peculiar products of the inflammation seem to arrest the organization of the fibrin, so that a carbuncle does not retain the apparently small size of its beginning, but spreads from a centre both through the subcutaneous tissue and the skin, becoming at times enormously large. It still maintains its circular form, and is sometimes several inches in diameter—two to four inches being a very common size, while it is often very much larger. Carbuncles may appear upon all parts of the body—even the soles of the feet and the palms of the hands, which have usually been thought to be exempt, not always escaping. The most favorite situation, however, is the firm tissue on the nape of the neck and the upper part of the back. An inflammation of this kind, with its products pressing so severely upon the neighboring structures, and in themselves seeming to possess some peculiar, irritating property, naturally results in the destruction of the dermoid and the subcutaneous tissue. Hence the tendency of carbuncle is to the production of a large slough.

It may be observed also that carbuncles are usually single, although cases are reported where several have appeared at the same time. The progress of carbuncles is not uniform, the inflammatory process being much more active in some than in others. The full process of sloughing, however, is apt to occur in the course of a fortnight, but at times it is delayed and continued through many weeks. The depth of the slough is usually that of the skin and the subcutaneous adipose tissue, extending to the fascia.

In an average of thirty-five cases in St. Bartholomew's Hospital, the time required for complete healing, or for healing so far as to permit the patient to leave the hospital, was about seven weeks. But when the destruction of tissue was large, several months were sometimes required for the completion of cicatrization. Of the thirty-five cases, ten were examples of facial carbuncle, and of these eight were in males. Of the twenty-five remaining, twenty-two were in males. In these thirty-five cases, the average age of those patients in whom facial carbuncle existed was 26.8 years; but in the other form of anthrax, it was 44.6 years.

Carbuncle occurs also, without distinction, at all periods of the year, and in almost equal proportions in the temperate and well-fed, as in the intem-

perate and ill-fed. Nevertheless, there are periods in the year, and also special years, in which there is a greater proportion of cases of this disease than during average years.

CAUSES OF CARBUNCLE.—The *causes* of carbuncle are but little understood. It has generally been believed to depend upon some peculiar constitutional vice of a temporary character; upon some abnormal fluid, the result of dietetic error. Some pathologists, however, have regarded its origin as purely local. It has also been asseverated that eating the flesh of animals afflicted with disease, such as the pleuro-pneumonia of cattle, has proved to be a frequent cause. It must be confessed, however, that while it seems probable that there is some specific cause for this disease, such a cause is still unknown. Among the predisposing causes, we may regard glycosuria as one well established. Some observers have been disposed to believe there is a very frequent connection between the two conditions, as glycosuria has been known to exist in persons during the existence of a carbuncle, who suffered from it neither before nor after the attack. But we know that glycosuria occasionally occurs as an evanescent condition, and it is more probable that this should give rise to a carbuncle than that a carbuncle should give rise to glycosuria. Moreover, since attention has been called to the matter, extended observation of the urine has shown that the combination is after all a rare one. But the frequency of the occurrence of carbuncle in chronic diabetics is a fact well established, and the disease under such circumstances is attended with much danger. It will be needless to say that in the treatment of such a case, the strictest confinement of the patient's diet to what is well known as the "diabetic list" is absolutely imperative.

PATHOLOGY OF CARBUNCLES.—The views that have been entertained with reference to the *pathology* of anthrax are various. Dupuytren believed that it was an inflammation of bundles of cellular tissue contained in the areolæ of the derma.

He described the derma as thick, white, and elastic, more consistent at its external than at its internal surface. The fibres, he said, interlaced, and were filled with bundles of cellular tissue. These were impregnated with a fatty fluid which distended the cells that contained it. The numerous areolæ of the derma had all a nearly conical form. Their summits corresponded to the reticular body, and their bases to the internal surface of the skin which reposed in all parts upon a layer of cellular tissue.

As we shall see hereafter, this histological description comes very near the truth, and must be regarded as remarkably accurate for the time at which it was written. But Dupuytren committed a great error when he added that anthrax only differed from furuncle by the extent and multiplicity of the cellular bundles which were inflamed at the summit. Sanson described anthrax as an inflammation of the processes of cellular tissue which accompany the vessels and nerves through the true skin; and declared that it differed only from furuncle in the extent of cellular tissue engaged. According to this writer, the mortification of the walls of the areolæ of the derma depends upon the distension to which they are submitted by the cellular tissue attempting to swell. Nélaton proposed another view of the pathology of carbuncle. He believed there was no strangulation, and that the "core" was not gangrenous areolar tissue, but a simple product of secretion—a veritable pseudo-membrane. The essential characteristics of anthrax and furuncle he regarded as identical, and maintained that these affections differed from each other only in form. As recent a writer as Professor Billroth regards furuncle and carbuncle as identical, and differing only in degree.

But the explanation given by Dr. Warren seems to leave little that can be controverted. He has been the first to call the attention of histologists to the existence of small columns of adipose tissue leading from the panniculus adiposus up to the roots of the lanugo hairs, taking an oblique direction in a line with the erectores pilorum. The inflammation resulting in suppuration of the subcutaneous adipose tissue, must either form an abscess or become diffuse. In phlegmonous erysipelas, the latter condition is observed. But when the inflammation is in the dermoid texture, the exudates infiltrate the skin, and naturally follow the canals occupied by the "columnæ adiposæ." The pressure thus exerted upon the whole dermoid tissue cannot fail to strangulate the circulation, and thus produce gangrene of the tissue, even if the exudate be not poisonous enough to destroy the cell by its presence. It can, by this explanation, be easily understood why this disease is apt to affect the skin on the nape of the neck and the back more than on other parts of the body, although, as has been said, it may occur elsewhere. At this point the skin is dense, its fibrous element extending deep into the adipose layer, which is surrounded with strong bands; hence, the pus confined in such a place, seeking the easiest outlet, will travel along these miniature adipose canals, producing the peculiar appearance already described as pathognomonic of carbuncle. We also recognize the reason for the development of the disease, when occurring in this place, to such huge proportions as it often assumes. The firmness of the tissue extrudes the pus laterally, as well as along these minute canals.

SYMPTOMS OF CARBUNCLE.—The constitutional *symptoms* are not usually severe, unless resulting from septicæmia, but they may have every grade of severity until they reach a fatal result. At first, the fever is slight, the patient suffering chiefly from loss of appetite, furred tongue, and general malaise, superadded to the local distress, which is often very great. As the process of suppuration and destruction goes on in the tissue, graver symptoms appear, the pulse rising to 100, 110, 120, or even higher. But we often find a large carbuncle running its course while the patient has but slight fever and is not confined to his bed. On the other hand, I have known a carbuncle, not more than an inch in diameter, and not presenting severe local symptoms, occurring upon the back of a man 28 years of age, prove fatal in five days.

PROGNOSIS.—Death is not infrequently the result of this disease. Exhaustion from sloughing is sometimes the cause of death, and occasionally it is produced by hemorrhage or by embolism. But it is obvious that the great source of danger is septicæmia, which may be exhibited in all its phases by the direct action of the poison on the blood, or by the production of secondary abscesses. In seven thousand eight hundred cases of carbuncle reported in our army during the War of the Rebellion, there were only eleven deaths. These results are so much better than are observed in civil practice, that the inference is justifiable that the fatality in early adult life is but slight, except in the facial form of the disease.

TREATMENT.—The *treatment* of carbuncle is more various than in most other diseases of the sloughing kind. The common method is to make two incisions, at right angles to each other, crossing at the centre, and extending through the hardened base at the border. This would seem to be the most natural mode of evacuating the pus, and of taking off the strain made by pressure upon the skin as well as upon the subcutaneous tissue, through which the incisions should extend. It comports with our practice wherever we find pus,

as being the best means of its evacuation. This was the practice of Dupuytren, Nélaton, and almost all surgeons down to the present time. But it unfortunately happens, that the pus is so infiltrated through the tissue in very minute canals, that the incisions do not evacuate it. This seems to be the only form of suppuration which is not relieved directly by the knife. The whole mass appears, when cut into, like a filthy sponge without its elasticity, and every surgeon must have observed that his incisions are by no means sure to arrest the extension of the disease, and much less its progress, in tissue already invaded. The advocates of incision urge the fact that surgeons confine their cuts too much to the obvious surface of the carbuncle, and declare that their success would be more marked if they were careful to extend their cuts into and beyond its apparent periphery. And it must be acknowledged that, if undertaken at all, the operation should be thoroughly carried out. An objection to this method of treatment is found in the fact that, if executed in this thorough way, a considerable amount of hemorrhage can hardly be avoided. Inflamed tissues, when incised, quickly unload their vessels, and although bleeding is not apt to be continued for a long time, it is still often considerable. Therefore, as a precautionary measure, pressure should immediately be brought to bear upon each side of the incision, to diminish the flow as much as possible; and even with this precaution the operation may, in old and feeble persons, become a very grave matter.

A modification of the plan of incision consists in the *subcutaneous section* of the carbuncle by a tenotomy knife, which, being entered beyond the edge of the induration, is pushed deep into the tissue, so as to be carried completely under it with its back downward; and when the point has reached the centre of the carbuncle, the cut is made so as to divide the tissue upwards into the skin, but without severing the surface. Four such cuts resemble the ordinary crucial incision, and claim the well-known benefits of subcutaneous surgery. The forefinger of the left hand will easily guide such an incision, and the hemorrhage will be but slight. This plan, brought forward by Mr. French, has been practised by himself and others for many years, and as it is claimed with great success, not only in the greater assurance of recovery, but also in the greater rapidity of cure and less destruction of tissue. This plan has also been varied by sweeping the knife around *flatwise*, in order to secure the greater liberation from tension, and, as is claimed, if practised early in the invasion of the disease, without endangering the vitality of the skin.

A special modification of the plan by external incisions is insisted on by some surgeons. A case by Dr. Blackly illustrates this mode of practice:—

He was called to see a broken-down man of sixty, suffering from an enormous anthrax covering the inferior portion of the scapula, and extending from its anterior edge to the spinous processes of the vertebræ. It seemed too far advanced to be benefited by mere crucial incisions, and, after making them, he snipped away the whole slough with forceps and scissors, going as near the sound parts as possible without wounding them. He afterwards drew the edges of the wound together with adhesive plaster, and thus obtained pressure upon the edges. The relief was instantaneous and the cure rapid. This should be called the method by *excision*.

The almost inevitable tendency toward sloughing has induced many surgeons to anticipate this destructive process by the use of *caustic potassa* rubbed rapidly into the tissue. This plan shortens the period of suppuration and sloughing, and probably diminishes materially the danger of septicæmia, by completing the destruction at once, and thus preventing the extension of the poisonous fluid into the surrounding tissue, where it could be absorbed. The author tried the experiment, in a single case, of rubbing

caustic upon one-half of a carbuncle, while leaving the slough on the other to the natural process of separation. This of course relieved the untouched half, but granulation was well established upon the cauterized portion many days earlier than upon the other. This plan of destroying by caustic the central part of the carbuncle, but not extending the cauterization as far as would be proper for incisions, was especially urged by Dr. Physick, who thus revived a practice which, however, had had its advocates long before.

But the potential cautery is not the only kind which has been applied with success. Professor Post has given us not only the result of his observation, but that of his personal experience, with the *actual cautery*, which he regards as almost an abortive remedy when applied early. I quote his account :—

In the spring of 1879, I had a circumscribed, indurated, inflammatory swelling over the right natis continuing a number of days, gradually increasing in size until its circumference equalled that of the butt end of a hen's egg, and until it had become so painful as to be an occasion of great annoyance. While the parts were in this condition, I requested my friend Dr. Hinton to apply the actual cautery to the middle of the inflamed part. The cautery used for this purpose was Thorp's multiple cautery, presenting six points about the size of a small knitting-needle. This was heated to a red heat, and plunged into the inflamed part, so as to extend through the skin into the subjacent tissue. There was a momentary, acute pain, but this rapidly subsided, and was followed by a sensible relief from that which had previously existed. The next day the swelling and hardness had diminished, and from that time there was progressive improvement, until within three or four weeks the parts were restored to a sound condition. There was no destruction of the cellular tissue, and no proper suppuration, only a slight discharge of bloody serum. In the course of the spring and the summer, I had four other attacks similar in their leading features to the first, and they were all treated substantially in the same manner, only one application of the cautery having been made after each attack. Within about a week after the application following the second attack, I started on a journey of two thousand miles, and scarcely suffered any pain from the long-continued sitting posture. During none of these attacks did I remain in the house for a single day, nor did I abstain from any of my ordinary avocations.

The severity of these various operations by incision, or by the use of the potential or actual cautery, properly demands the use of general or local anæsthesia : it has been shown that the spray will produce no unfavorable consequences from the reduction of temperature during the operation, and that it is capable of absolutely relieving the pain ; if, however, it should be thought best, general anæsthesia may be employed, for either the method by incision or that by the application of the cautery, to be beneficial, should be efficiently practised. Dr. H. Hunt and Dr. Leitner advise the use of a cupping-glass to supplement the incisions, thus creating by a kind of *aspiration* a force to draw the pus and other exudates from the periphery to the central opening. This cup can be made to include the whole tumor, and can be made to act by the simple method of heat, so that a tumbler or a bowl may be used of a size adapted to the case. This should be applied twice a day, and will always cause a flow of pus from the deeper parts, thus immediately relieving the strangulation and tension.

Another plan of treatment consists in the proper application of *pressure*. Its most strenuous advocate was Dr. O'Ferrall, who applied a covering of *emplastrum saponis* over the whole surface of the carbuncle, and extending beyond its indurated base. This case of his illustrates the practice :—

The *emplastrum saponis cum opio*, without an incision in it, was applied upon the carbuncle in its earliest state, while it was still hard and livid, with a vesicle or two,

and about an inch in width, but surrounded by a deep-seated infiltration easily to be felt at a distance of two inches in either direction. The next day the burning pain was gone. Pustules, however, appeared, but the deep dusky redness was diminished; a little suppuration only occurred. A small cross-cut in the plaster was then made, with a fresh application daily. In less than a week the core was entirely removed by a gentle pull at the time of daily dressing. The healing process now rapidly advanced, and the patient left on the eighteenth day.

A modification of this plan has been practised by Dr. Ashhurst with great success in several cases. Strips of ordinary adhesive plaster are applied concentrically, beginning well beyond the limits of the carbuncle, and gradually covering it in, each layer overlapping its predecessor till the whole surface, except about three-fourths of an inch square, in the centre, is covered. Under this treatment the swelling is rapidly subdued, the sloughing and suppuration being confined to the central area.

In one case, carefully measured, the carbuncle was reduced from a diameter of five and three quarters by four inches to one and a quarter inch each way, in a period of seven days, while the slough was all removed in eight days from the incipiency of the disease. Pressure, so far from being painful, procures relief; the dressing, whether by straps or plaster, must be renewed daily, in consequence of its becoming loose.

In this connection, the author may say that he has obtained satisfactory results by using a ring of cotton cloth stuffed with cotton-wool, and held down by a bandage so as to produce pressure upon the border of the carbuncle, thus driving the pus toward the centre, and preventing the extension of the disease. A modification of the plan by pressure, striving to obtain also the therapeutical effect of *iodine* in relieving the inflammatory condition, has been brought forward by Mr. Higginbottom. He uses the preparation known as *Pigmentum iodinii cum collodio*, which is made with a scruple each of iodine and iodide of potassium to the ounce of collodion. This pigment being painted daily over the indurated part, steadily contracts, and pressure is thus constantly maintained. Mr. Higginbottom's custom was, however, to use this in connection with destruction of the central portion of the carbuncle by caustic. This plan was warmly advocated by Seiche, who treated eleven patients in the ordinary way with incisions, six of these dying, and five of them from pyæmia. He treated twelve afterwards with collodion, and all recovered.

The *abortive* treatment of carbuncle has had but little success. Professor Jordan proposes the use of iodine applied as a counter-irritant widely around the diseased point, going, if this be upon the nape of the neck, to the roots of the hair and sides of the neck, out to the shoulders, and down on the back for several inches.

Such a variety of opinions with reference to the proper therapeutics of carbuncle, has led many surgeons to believe that *no treatment* is as useful as any of these active measures. A slough of certain dimensions is very sure to occur, and they prefer to leave the process of its formation and separation to nature, rather than to interfere in any active manner. They urge the consideration already mentioned, that the cut surfaces increase the facility of absorbing the necrosed exudates, without materially hastening the result.

Dressings.—The local applications—which may be called the dressings of the sore, day by day—are, by universal consent, of the emollient kind, and such as favor the removal of the secretions. Soft poultices of bread, of flaxseed, or of slippery-elm, are commonly applied as a soft covering, but other surgeons resort to the yeast poultice and charcoal, for purposes of disin-

fection. There are others, again, among whom may be enumerated the author of this article, who believe that frequent washings with *carbolized water*, especially if used with a syringe, followed by the application of lint or absorbent cotton, which, by capillary attraction, takes up the secretion as formed, is the best mode of local treatment.

I may mention here the experience of Dr. Leavitt in the use of *permanganate of potassium* as a local application. A strong solution of this salt, half a drachm to the fluidounce, was applied with a brush immediately after incision, and a dressing saturated with the same wash left in the wound. The effect was immediate and rapid.

When the sloughs have been entirely removed, the treatment of the disease differs in no respect from that of any other granulating surface. The firm application of adhesive plaster rapidly brings the edge of the skin to its normal condition, and a carbuncle which has been four inches in diameter will be found to have destroyed less than two inches of skin.

Constitutional Treatment.—The constitutional treatment of carbuncle should obviously be of the kind known as "supporting." The deep coat of fur ordinarily upon the tongue, with the usual constipation, indicate the necessity for a cathartic, which it is usually better should contain a mercurial ingredient. But this must be supplemented by a nutritious diet, embracing such articles as beef-juice and milk-punch, and aided by quinine. As the pains are apt to be severe, anodynes are obviously indicated, but no specific has thus far been discovered. The treatment, however, may be by no means always quite so simple. Notwithstanding the fact that we are not aware of any special and specific cause for carbuncle, there are patients who suffer from a number of them in succession. Such persons will exhibit usually dyspeptic symptoms, which will require special treatment, guided perhaps by the patient's antecedent experience. Dr. Gibbons, who in his own person was a victim to what might be called the "carbuncular diathesis," found relief from the free use of citric acid taken in the form of lemonade.

Facial Carbuncle.

This form of carbuncle presents the peculiarity of attacking younger subjects than that which occurs on other parts of the body than the face, but scarcely affects children. In appearance the disease is similar to that occurring in other parts of the body; but in consequence of the loose tissue of the face we do not find there the peculiar flat form of the surface heretofore described. It is more round, and, like other inflammatory swellings of the face, out of proportion to the actual amount of tissue directly involved.

The lip is a favorite seat of the facial carbuncle, and from hence it extends to the cheek. In consequence of this peculiarity, and from its special dangers, the disease has been confounded with *malignant pustule*, but the appearance of points of suppuration separated from each other clears up the diagnosis. Notwithstanding the youth of the subjects affected, which we might suppose would improve the chances of recovery, facial carbuncle has been found to be the most dangerous form of the disease.

The chief cause of death in ordinary cases of carbuncle is obviously septicæmia, to which, as mentioned above, we may add embolism, which is sometimes, though rarely, observed in this affection. But in facial carbuncle the chief cause of its fatality appears to be the extension of the inflammatory process along the veins, even to the sinuses of the brain. This has now been proved by several autopsies.

TREATMENT.—The treatment, as recommended by Dr. Leale, is to first locate the artery of the lip by pressing one finger beneath and another over the lip, when the arteria septi nasi will be felt strongly pulsating. A free incision is then made, without wounding the artery, the entire length of the induration, exposing the centre of the pustular mass. Now, with a piece of ivory or wood, about the size of a quill, with its end thoroughly wound around with cotton, fuming nitric acid is applied to all the diseased parts, and, while being applied, is pressed into all the surrounding pockets of pus, so as to break down all intervening bands of tissue; this application is to be repeated daily when necessary.

VENEREAL DISEASES: GONORRHŒA.

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' THE word GONORRHŒA, although etymologically inaccurate as a designation
of the disease in question, is still so universally employed and so well under-
stood, that it has been retained in this article for the sake of convenience.
The old English but now vulgar term " clap" is no better, lacking even the
slight descriptive force of its French and German congeners, *chaude-pisse* and
tripper. For reasons to be presently stated, *urethritis* will be used inter-
changeably with gonorrhœa, as the term that most precisely and compre-
hensively describes the most common manifestation of this malady, which,
exclusive of the diseases of childhood, has probably affected at some time
in their lives a larger proportion of the males of the community than any
other single ailment. This extreme frequency—which will not be ques-
tioned by those who have had much opportunity of observation in this direc-
tion—of itself renders the disease of sufficient gravity to entitle it to careful
consideration, even if the harmful consequences commonly attributed to its
direct or indirect influence be denied.

HISTORY OF GONORRHŒA.

As to the *history* of gonorrhœa, which may be briefly dismissed, there is
quite sufficient evidence to show that inflammation of the urethra, attended
with purulent discharge appearing at the meatus, and capable of being trans-
mitted from person to person by contagion—that is to say, of " gonorrhœa"
precisely as we now know it—is a disease which has existed from the remotest
periods of antiquity, the writings of Moses, of Herodotus and Aristophanes,
of Celsus and Hippocrates, of Rhazes, Avicenna, and Albucasis, all containing
more or less accurate descriptions of such a urethritis, which affected their
cotemporaries, and which was then, as now, accompanied or followed by
numerous complications.

The disease may be tracked across the middle ages with even greater facility,
although it was then confused with the various manifestations of syphilis,
and was not definitely separated from that affection until the early part of the
present century, since which time the non-identity of these two diseases has
been but rarely and feebly disputed. The only debatable ground in the con-
sideration of gonorrhœa at this time is the question of its specificity, or
invariable dependence upon a virus which is said to constitute the contagious
element, and to impart to the disease such distinctive—" specific"—characters
as clearly to separate it from other affections.

Nature of Gonorrhœa.

As this subject is not only of theoretical interest but of great practical importance, the views held influencing both prognosis and treatment, and sometimes important medico-legal opinions, etc., it will be useful to look carefully at both sides of it.

Those diseases which are called " specific," and which are recognized as distinct clinical or pathological entities, or as depending upon definite and invariable sources of origin, have, as a class, certain peculiarities which more or less accurately characterize them; they have a period of incubation intervening between the time of exposure to infection and the outbreak of the first symptoms; they cannot be caused by traumatic influences or by anything except the essential virus of the disease, which through some channel must find its way into the general circulation; they usually protect from a second attack; they are, in the majority of cases, accompanied by distinctive pathological changes or processes, which distinguish them from diseases the result of mere irritative action; they run a definite course, and, after their termination or subsidence, cannot be reawakened at will by any known agency.

In gonorrhœa, not one of these conditions obtains. There is no definite period of incubation—indeed, none at all, except that which always intervenes between the contact of an irritating foreign substance and the production of a sufficient degree of inflammation to excite subjective symptoms. A large number of widely dissimilar causes are capable of developing the disease in its greatest intensity; authentic cases are recorded of well-marked urethritis following accidental or experimental exposure to leucorrhœal discharges; to the pus from a healthy abscess, or from a purulent bronchial catarrh; to the secretion from an endo-cervicitis or endo-metritis; to the discharge resulting from ulceration or malignant disease of the uterus; to the menstrual fluid or acrid vaginal discharges; to powerful injections; to the passage of gravel; to catheterism; and to many other undoubtedly non-specific causes. The condition thus evoked is in no wise distinguishable from that following sexual intercourse with a person already having a similar disease, some of the most severe and most complicated cases of gonorrhœa which have fallen under the notice of the writer having been derived from one or the other of these sources. The assertion that in so-called " true" gonorrhœa the disease has a peculiar tendency to become chronic or to run into obstinate gleet, while on the other hand " simple" gonorrhœa, or urethritis, tends to subside spontaneously, cannot be admitted as an argument based upon clinical facts. It may be positively stated that no sound inference as to the cause, in any particular case, can be drawn from its course or symptoms, and that the variations observed in the different grades of urethritis are no greater than those which prevail among inflammations of other mucous passages, and which are due to individual idiosyncrasy, or to differences in the power of the original irritant.

So far from exercising any protective influence against subsequent attacks, gonorrhœa, like tonsillitis, laryngitis, bronchitis, enteritis, cystitis, etc., predisposes to them, often, especially if it has been protracted, leaving the urethra in an atonic, relaxed, or catarrhal condition, or else roughened, granular, and congested. It is exceedingly common to have patients remark that, although frequently exposed to contagion, they went many years without contracting the disease, but that since the first attack they acquire it every few months, which circumstance they usually attribute to " bad luck," or, not infrequently, to an imaginary necessity for conforming to a general average.

In observing the course of gonorrhœa from a pathological standpoint,

nothing whatever is found to occur, either as to the manner of attack or the tissue or tissues invaded, which separates it from ordinary catarrhal diseases; nothing, for example, analogous to the induration of the chancre, the ulceration of Peyer's patches, the dermatitis and pustulation, which, by their almost unvarying presence in syphilis, typhoid fever, and variola, are entitled to be called specific characters in those diseases.[1]

The occasional occurrence of articular disease, "gonorrhœal rheumatism," and of a sclerotitis, "gonorrhœal ophthalmia," as complications of urethritis, has been frequently attributed to some peculiar property supposed to belong solely to gonorrhœal pus, and never originating apart from contagion. Since, however, it has been found beyond dispute that these inflammations of fibrous tissue may complicate urethritis due to traumatism, and that they are in all probability mild pyæmic manifestations following the absorption of purulent products through the delicate urethral mucous membrane (see p. 346), this argument has lapsed. The term "urethral synovitis" has been proposed as a substitute for the former, and is in every way preferable. The intense form of conjunctivitis following contact with pus resulting from a urethritis, has also been shown by experiment to be in no sense a specific process, pus from an eye affected with ophthalmia neonatorum having produced a characteristic urethritis, which in its turn proved transmissible, and gave rise to a typical conjunctivitis.

After gonorrhœa has apparently subsided, any indiscretion in diet, any sexual or alcoholic indulgence, any local irritation, may, and frequently does, serve to reproduce it in all its original intensity, and this may be repeated an indefinite number of times. Nothing at all analogous to this occurs during the course of any of the diseases with which we are comparing it. Unless the peculiar virus is supposed to be generated anew in each case of traumatic urethritis, an untenable theory, it becomes impossible in the light of clinical observation to explain these peculiarities and variations in the cause of gonorrhœa on the supposition that it is truly specific in its character.

The facts which have thus been stated may be briefly presented in a tabular form:—

GONORRHŒA.	SPECIFIC DISEASES.
No period of incubation.	Definite period of incubation.
Caused by a variety of agencies, chemical, traumatic, and infectious.	Caused always by the absorption of a definite virus or morbid product.
Predisposes to a second attack.	Protect from a second attack.
Associated only with ordinary processes of inflammation.	Have distinct and almost unvarying peculiarities as regards their pathology.
May be re-awakened or reproduced at will and indefinitely.	Run a definite course, and cannot be made to return after its completion.

Dr. Fordyce Barker speaks of a peculiar form of urethritis which has associated with it a leucorrhœal discharge, that in repeated instances has produced a purulent urethritis in the male. Dr. Otis records the case[2] of a gentleman who had been married

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[1] "Chiefly affecting mucous membranes, gonorrhœa has all the characters of ordinary inflammation of mucous membrane; it begins near the surface where the contagious secretion is first applied, and thence spreads towards the interior of the body; it is attended by redness, with scattered or more general hyperæmia, swelling of the mucous membrane, considerable increase in the secretion of mucus, with the addition of many wandering leucocytes, and, in severe inflammation, also of red corpuscles; subsequently the swelling, hyperæmia, increased mucous secretion, and escape of leucocytes diminish, the superficial epithelium desquamates, and the secretion of mucus gradually abates. Such are the anatomical characters, and they are those of any catarrhal inflammation."—Prof. H. Lebert (a strong advocate of the doctrine of specificity), in Ziemssen's Cyclopædia of Practical Medicine, vol. viii. p. 752.

[2] Medical Record, June 8, 1878.

one year, and in whom a urethritis had appeared soon after his marriage. This disappeared under treatment, but subsequently redeveloped three or four days after each sexual congress with his wife. Upon examination it was found that she suffered from retroversion of the uterus ; that the surface of the external os was eroded, and covered with a thin layer of muco-purulent material. The uterus was restored to its normal position and retained by a pessary. The lady made a prompt recovery, and from that time the gentleman suffered no more from his urethral trouble.

Mr. Milton, an ardent supporter of the theory of specificity, admits[1] that "urethral discharges do appear in men as the result of connection with women laboring under leucorrhœa," but says that such a discharge is "*usually* much milder than gonorrhœa in its symptoms," which we have no doubt is true. We may also agree with him that "even a slight amount of gonorrhœa is more likely to excite the same disease in another person, than a pretty high degree of leucorrhœa is to bring on a simple urethritis." Leucorrhœal discharges are sometimes almost entirely mucous, and in such cases are probably innocuous. Gonorrhœa, in the sense in which he uses the term, always contains pus, which is undoubtedly the most active and most frequent source of urethritis, only it need not be in any sense "specific."

Unquestionably the strongest argument urged in favor of the specificity of gonorrhœa, is the fact that those married men who refrain from intercourse with other women than their wives, enjoy comparative immunity even although the latter are the subjects of leucorrhœa. There can be no doubt that in the vast majority of cases such men either escape all forms of urethral inflammation, or at the most suffer from a catarrhal urethritis, and rarely or never develop an acute, inflammatory condition. This as a clinical fact is denied by no one, but was explained by Ricord on the theory of "acclimation;" the husband is said to become "seasoned" or accustomed to the discharges of the wife, so that they have no effect upon him, although at the same time, as is shown by many authentic cases, they may give rise to a violent gonorrhœa in a third person. This is doubtless also true to a great extent, yet it hardly seems to me entirely satisfactory, or to explain, for instance, the escape of those men who marry women already affected with leucorrhœal discharges, and who, of course, are not already "acclimated." Great numbers of such marriages continually occur, and yet it is very rare, at least among well-to-do people, to find the husband developing gonorrhœa, even although the predisposing influence of the sexual excesses not uncommon in early married life be added to the possible exciting causes existing in the woman's condition. In dispensary practice, however, it is not so exceptional an occurrence, and is occasionally a source of domestic discord. I have seen several such cases within the last year. Here again it must in fairness be admitted that the women concerned are hardly above suspicion; and although it is the duty of the physician under the circumstances to give the woman the benefit of any doubt as to the precise character and cause of her ailment, it cannot be denied that the doubt frequently exists. The only explanation of these facts which seems in accord with the various powerful arguments in favor of the non-specific character of gonorrhœa, is that which attributes the production of the disease to the combined influences of neglect of personal cleanliness and hygienic precautions on the part of both the woman and the man, together with sexual and possibly alcoholic intemperance.

Fournier has shown that of 387 women known to have been the source of gonorrhœal infection, only 56 were prostitutes, the other 331 being made up of married women, kept women, shop girls, and domestics, or, in other words, of women with whom illicit intercourse was often of necessity clandestine, hurried, or performed under circumstances which did not admit of thorough ablution. Such women are of course more apt to be the subjects of uterine or vaginal catarrh, the secretions from which, if

[1] Pathology and Treatment of Gonorrhœa, p. 6.

retained as a consequence of neglect, are much more likely to be purulent and contagious than in women who live a regular and well-ordered life, and who are careful about their personal condition.

If these factors be duly considered, the escape of married men, the infection of "lovers," the comparative harmlessness of prostitutes (who learn to attend to cleanliness as a matter of business), and the great frequency with which the disease is contracted from certain classes of women, all become comprehensible, and may be said, in *résumé*, to depend upon the generally admitted facts, that in the female a purely mucoid discharge, or one with but slight purulent admixture, is contagious only to a very moderate extent;[1] that regularity in the performance of the sexual functions, absence of excesses of all sorts, and attention to personal cleanliness—circumstances usually existing in married life—tend to preserve the non-purulent character of such discharges; and that these conditions are usually reversed when intercourse is illicit, and particularly when it takes place with women who do not practise it as a profession. Consequently, we are not compelled to depend upon "acclimation" as the sole explanation of the immunity of married men, while at the same time we may maintain the original proposition, that gonorrhœa may be contracted from all forms of uterine and vaginal discharges.

The importance of having well-grounded and clearly defined views upon this subject, becomes evident upon reflection. If we assert or believe in our ability to recognize by certain symptoms a specific gonorrhœa, which could only have been obtained, except in instances so rare that they might practically be excluded, by contact or intercourse with an individual of the opposite sex having the same disease, we shall frequently be compelled either to prevaricate or actually to falsify, or else in many cases to put an end to domestic happiness or cause infinite misery and suffering. If a man with all the symptoms, presently to be detailed, of a typical case of gonorrhœa, asks the point-blank question as to the cause of his disease, and if, true to the "virulent" theory, and careless or ignorant of his sexual or matrimonial relations, we reply that it has almost certainly resulted from a similar discharge produced in its turn by a similar cause, we may possibly—indeed, taking the average of a large number of cases among the better classes, it is safe to say we will probably—do some innocent woman a great injustice, and, as in one instance of which I am personally cognizant, may even indirectly cause her ruin and death. It is never safe or proper to say that a given urethritis, vaginitis, or vulvitis, has resulted from impure sexual intercourse, although we may admit that the latter is the most *frequent* cause of these diseases.

There is a marked difference between the sexes as regards susceptibility and exposure to contagion, which we should remember for our own instruction, observing, however, the same caution as to expression of opinion. A man with a urethritis may have derived it from any one of the sources which have been mentioned, the woman, if it follow sexual intercourse, having been quite free from any truly venereal disease. In the majority of cases in which I have been asked to examine women suspected under these circumstances, I have failed to find any evidence of gonorrhœa in any of its forms. On the other hand, in the absence of traumatic or mechanical irritation, if a woman develops gonorrhœa—that is, a vulvitis, vaginitis, or urethritis—it is strong presumptive evidence that she has been exposed to contact with the secretion from a similar inflammation affecting the male urethra. The possible infecting or exciting causes of gonorrhœa in women are obviously much fewer

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[1] Mr. Milton's rule, already quoted, that "even a slight amount of gonorrhœa is more likely to excite the same disease in another person than a pretty high degree of leucorrhœa is to bring on even simple urethritis," is a statement of this same fact, possibly a little exaggerated.

than in men, as the genital and urinary apparatus in the male is neither so extensive in surface nor so subdivided functionally as in the female, and her chances for contact with morbid secretions, other than that from a purulent urethritis, are correspondingly limited.[1]

Varieties of Gonorrhœa.

Gonorrhœa may then be defined as an inflammation of the urethra in the male, of the vagina, vulva, or urethra in the female, depending upon some local irritation for its development, the most common cause being contact during sexual intercourse with purulent or disordered secretions from the genito-urinary tract. In practice we meet with three distinct varieties of the disease, which are of definite clinical importance, and which may be described as :—

I. Typical or acute inflammatory gonorrhœa;
II. Subacute or catarrhal gonorrhœa ;
III. Irritative or "abortive" gonorrhœa.[2]

Distinctions based upon minor variations in the form or seat of the inflammation have been made, chiefly by those observers who have employed that very unsatisfactory instrument, the urethral endoscope. They have thus described a *membranous* urethritis with inflammation of the dorsal lymphatics of the penis ; a *granular* urethritis, with numerous punctiform elevations of the mucous membrane; a *suppurative* urethritis, with the formation of abscesses in the submucous connective tissue ; and an *ulcerative* urethritis, noticed in persons predisposed to herpes. I have never been able to distinguish these different forms with any degree of accuracy except when they have given rise to well-marked symptoms, such as follicular or peri-urethral abscess in the "suppurative" form, hemorrhage after urination in the "ulcerative" variety, etc.[3] For practical purposes they may safely be ignored, and the division or classification above suggested may be adhered to.

[1] At intervals of a few years the doctrine of the dependence of gonorrhœa upon the presence and growth in the urethra of vegetable organisms—bacteria and micrococci—is revived and discussed. Neisser, Salisbury, Bokai, and lately Mr. Cheyne, Assistant Surgeon to King's College Hospital, have claimed to base their diagnosis and treatment of the disease upon the existence of these organisms. As their observations have never been confirmed, except as to the discovery of micrococci such as are found in pus under all circumstances, and whencesoever derived, and as the antiseptic plan of treatment is usually a conspicuous failure in cases of gonorrhœa, it will not be necessary further to allude to these theories.

[2] Lebert classes the two latter forms together under the name of "slight, superficial, sero-purulent and mucous gonorrhœo-catarrh."

[3] J. Grünfeld (*Cbl. f. Chir.*, 1878, No. 21 ; from *Wiener med. Jahrb.*), as a result of his experience with the endoscope, describes the following forms of urethritis, which closely resemble those above given: (1) *Urethritis blennorrhoica*, acute blennorrhœa of the urethra without complication. The field of vision of the endoscope is filled with greenish pus, the mucous membrane underneath markedly reddened, greatly puffed out, and showing erosions here and there. The so-called lacunæ of the mucous canal are wanting, or their depth is reduced to a minimum. (2) *Urethritis membranacea*, characterized by striated layers of grayish-white membrane, the removal of which gives rise to slight bleeding. This form of disease is ordinarily complicated by inflammation of the dorsal lymphatics of the penis. (3) *Urethritis simplex*, a less marked variety of U. blennorrhoica, the mucous membrane being somewhat red and swollen, with injected bloodvessels ; the lacunæ decidedly evident. (4) *Urethritis granulosa*. The mucous membrane is evenly colored ; no isolated bloodvessels can be seen ; wrinkles are for the most part wanting, but numerous punctiform elevations can be perceived, which are distinguished by reflecting light from their surface. (5) *Urethritis with the formation of abscesses*, which occasionally originate in herpes blebs, occasionally are chancrous sores, and sometimes proceed from badly treated strictures.

A form of gonorrhœa known as "gonorrhœa sicca," or "dry gonorrhœa," and unattended with discharge, is discussed by some authors. I have never seen a case of this disease, and am disposed to agree with Van Buren and Keyes, who attribute the symptoms—pain, ardor urinæ,

Acute Inflammatory Gonorrhœa of Male Urethra.

Taking up the subject of gonorrhœa in the male, we may begin with a description of the acute inflammatory variety, which is the one most frequently encountered, particularly in those persons who are for the first time affected.

The interval which elapses between exposure to irritation and the development of noticeable urethral symptoms, is a variable one, extending from a few hours to twelve or fourteen days. In the great majority of cases, however, the disease appears during the first week, and intelligent or observant patients usually discover indications of its presence within two or three days. Such persons will often tell you that they have experienced an obtrusive consciousness of the possession of a penis, an involuntary turning of the thoughts in that direction, a disposition to search or examine the organ, although no pain is felt, and no discharge can be seen. In a short time, however, one or the other of these symptoms makes its appearance, or they occur simultaneously. The patient notices a drop of milk-and-watery fluid at the meatus, which is slightly red and puffed or everted; a tickling sensation is often felt in this locality, and the next act of urination is attended with a feeling of warmth at the end of the canal, or with actual scalding. After this, the symptoms increase rapidly in number and severity, so that within forty-eight hours, or even sooner, the disease may be described as having gotten well into its first or "increasing" stage, the characteristic phenomena of which, with their respective causes, may be enumerated as follows:—

Symptoms of First or Increasing Stage of Gonorrhœa.

CHANGES IN MEATUS.—There are *redness, eversion,* and often *erosion* of the lips of the meatus; sometimes, but rarely, so much swelling as to constitute a distinct obstacle to the passage of the urine, which escapes only by drops.

ARDOR URINÆ.—*Scalding* at each act of urination, or *ardor urinæ,* is the symptom which gives the disease in French its popular name of *chaude-pisse.* This is due partly to the distension of the inflamed and swollen mucous folds of the urethra during the passage of the stream, but chiefly to the contact with the inflamed surface of the salts of the urine. That this latter is the principal cause, is shown by the favorable influence which diluent and alkaline diuretics have over this symptom, although they actually increase the size of the stream, and consequently the amount of distension.

CHORDEE.—Painful erection, or *chordee,* is present to a greater or less extent in all such cases. It may occur at any time during the twenty-four hours, but is most frequent after the patient has become warm in bed. He is awakened or kept awake by an intractable, persistent priapism, which is associated with pain felt along the under surface, or often along the sides of the penis. In well-marked cases the organ is bent or curved, usually in a downward direction, more rarely upward or laterally. The corpus spongiosum, situated beneath and between the corpora cavernosa and surrounding the

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etc.—to urethral neuralgia, and assert that the malady is not in any sense a gonorrhœa. Jullien thinks, however, that it is not illogical to consider the mucous membrane of the urethra as affected, in such cases, by an inflammation analogous to that of cutaneous erysipelas, the products of which in "blennorrhagie sèche" may be so slight as only to be detected by a careful examination of the urine. (Maladies Vénériennes, p. 35.)

urethra, is more directly involved in the inflammatory process than the other portions of the penis. The urethritis is not confined solely to the mucous layer of the canal, but extends by contiguity to the submucous connective tissue, and thence continuously to the trabeculæ of the erectile tissue of the spongy body. The lymph, which is exuded in these localities, blocks or fills up the inter-trabecular spaces or meshes containing the intricate venous plexus which, by its engorgement and distension, furnishes the essential mechanical element of normal erection. When, either in response to sexual desire, or as a result of the local irritation of the urethritis, or induced by the contact of accumulated urine with the neck of the bladder, or suddenly occasioned by spasm of the muscles controlling the return of blood from the penis, the organ becomes erect, the corpora cavernosa expand normally and fully, but the blood is unable to find its way into the partially obliterated erectile tissue of the corpus spongiosum, which remains rigid and inflexible. The pain along the sides is produced by the pressure on nerves caused by the unnatural position, and that along the under surface by the attempted distension of the inflamed tissue of the spongy body. There is an analogous condition, consisting of a chronic circumscribed inflammation of the corpora cavernosa, in which erections are equally painful, but in which the curve is upward ; or, if only one cavernous body is involved, the bend is lateral, and toward the affected side.

One explanation of the mechanism of chordee attributes the bending of the penis to spasm of the layer of longitudinal muscular fibres said partially to encircle the urethra.[1] These, however, are very scanty, are sometimes almost entirely absent, and have no normal functional activity. It is hardly conceivable that, even under persistent irritation, they should exert sufficient force to produce the severe and often long-continued bending of the penis found in chordee. Then, too, the characteristic pain in erection is frequently experienced without the least curving of the organ.

According to Hilton,[2] when the erection occurs suddenly, the cause is spasm of the muscles which control the blood supply to the penis, the spasm being due to irritation of branches of the pudic nerve, which are distributed to the inflamed mucous membrane of the urethra. The sudden and severe erections which occur during sleep are attributed by the same author to excito-motor action roused in the spinal cord when it is deprived of the control of the brain. Mr. Hilton also suggests that the greater distension of one side of the penis than of the other, which often occurs, may depend upon a greater amount of irritation on the corresponding side of the urethra. The variety of chordee which is produced by the effusion of inflammatory products into the corpus spongiosum, is considered by him to be quite distinct from the preceding forms.[3] This explanation seems as far removed from the truth as that of Mr. Milton, mentioned above. At least, I have never seen any cases which could be distinguished as being due to muscular action. Doubtless erection is prolonged by the tendency of the erectors and compressors to spasm, but that this is in any sense the cause of either the pain or the deformity of chordee cannot, I think, be admitted.

FREQUENT URINATION WITH VESICAL TENESMUS is another symptom which occurs about this time in many cases. It generally indicates an extension of the inflammation to the deep urethra, but may exceptionally be due to reflex influence from a disturbance as yet localized at or near the meatus. In either event, the irritability of the neck of the bladder is shown by the inability of that organ to retain more than very small quantities of urine, and by the urgency of the calls to evacuate it, the difficulty in starting the stream, and the bear-

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[1] Milton, op. cit., p. 184.
[2] Lectures on Rest and Pain, 2d ed., p. 255.
[3] Hill and Cooper, Venereal Diseases, p. 497.

1. Acute gonorrhœa with partial phimosis. 2. Balano-posthitis with herpetiform ulceration. 3. Paraphimosis with consequent ulceration. 4. Gonorrhœa in woman.

ing-down, expulsive efforts which accompany or follow the dribbling of the last few drops.

The *discharge* during this period has been growing more and more profuse. At first thin, and of a bluish-white hue—like city milk—it has become white, then yellow, and then greenish or streaked with blood-stains. If actual ulceration has occurred, it may contain a considerable admixture of blood, a few drops of which will follow each urination, produced by the rupture of minute capillaries during the contraction of the circular muscular fibres which takes place at the end of that act.

We have, then, certain conditions—ardor urinæ, profuse purulent discharge, chordee, and frequent urination—which characterize the increasing stage of inflammatory gonorrhœa, and all of which occur with so much frequency that they should be regarded as symptoms of that stage, and not classed, as is sometimes done in the case of the two latter, with the complications. Under this head, however, and observed during the same period, some annoying and troublesome results of inflammatory action may be described.

COMPLICATIONS OF FIRST STAGE.

BALANITIS.—When the inflammation, instead of remaining within the urethra or involving only the lips of the meatus, extends over the surface of the glans penis, we have the condition known as *balanitis*. This is usually caused by a neglect of cleanliness, the urethral discharge being permitted to remain in contact with the head of the penis, or allowed to accumulate under the foreskin, but it occasionally occurs, as has been said, from a simple extension of inflammatory action by continuity, and in spite of the greatest care. As in the case of gonorrhœa itself, some patients seem to be peculiarly subject to the development of this form of inflammatory action, and it has been noted that persons who have been troubled with erythema intertrigo are usually sufferers from this complication. In dispensary and hospital practice it is seen in about one-fourth of all cases, in private practice not nearly so often. The susceptibility to irritation of the mucous membrane of the glans is, for obvious reasons, much less than that of the urethra. Pus which would instantly excite an active urethritis, may often be permitted with impunity to bathe this region ; astringents, such as nitrate of silver, which, when injected *per urethram*, give exquisite pain, have little or no effect on the thicker epithelium of this part, which, in circumcised persons or those with short or retracted foreskins, closely resembles epidermis in density and insensitiveness. If it were not so, the most scrupulous cleanliness would not prevent the large majority of patients with the variety of gonorrhœa under consideration from having this complication.

Symptoms and Diagnosis of Balanitis.—Its symptoms are those of superficial inflammation, heat, redness, burning or itching, and finally exfoliation of epithelium, leaving an eroded or sometimes a superficially ulcerated surface. Not infrequently little crops of herpetic vesicles (see Plate VI. Fig. 2) appear, and may remain discrete until they desiccate, or they may pustulate, coalesce, and leave an ulcer which is sometimes mistaken for a chancre or chancroid.

Between the balanitic ulcer and the chancroid, the differences seem to me chiefly those of degree, a more intensely irritating or corrosive pus causing deeper and more intractable ulceration. Indeed, I have on more than one occasion seen balanitic ulcers subsequently removed from treatment by the

occurrence of phimosis, and at a still later period disclosed by operation, in which all the so-called specific characters of the chancroid—the abrupt or undermined edges, the tendency to spread, the profuse discharge, etc.—were present. The diagnosis here is of no great importance, as treatment should be applied in either event on the same principles. Mild local measures suffice in both cases to cure the majority of sores; in those which continue to extend or which remain intractable, cauterization with nitric acid is indicated both theoretically and empirically.

The form of the initial lesion of syphilis known as the *chancrous erosion*, may be mistaken for a superficial balanitis. The period of incubation, the absence of urethral discharge, the abrupt limitation of the erosion, the presence at its base of "parchment" induration, the enlargement of the inguinal lymphatics, and the lack of inflammatory element, are symptoms of the former condition which should render it easily distinguishable from a solution of continuity due to balanitis.

BALANO-POSTHITIS.—An extension of the inflammation from the surface of the glans to the inner or mucous layer of the prepuce gives rise to what is known as *balano-posthitis*, which has no special clinical significance, except that it is almost invariably followed by, or associated with, an inability to retract the foreskin, so as to uncover the glans penis.

This is due to an extension of the inflammation to the loose cellular tissue uniting the two surfaces of the foreskin, which rapidly becomes œdematous, and in some cases is the seat of an effusion of plastic lymph.

PHIMOSIS.—The *phimosis* thus produced is an extremely objectionable complication, as it interferes with treatment, necessitates most vigilant and unremitting care as to cleanliness, and obscures diagnosis and prognosis. If the case has not been watched from the beginning, and the patient comes under observation for the first time with a vague history and with an œdematous, swollen prepuce (see Plate VI. Fig. 1), from the orifice of which pus or pus and blood exude, it is not always easy to determine the exact underlying condition. An indurated chancre can generally be discovered without trouble by its hardness, and is moreover not often complicated in this manner. A soft or chancroidal sore, however, or a balanitic ulceration, may not be so readily recognized. The main points of distinction may be tabulated as follows:—

PHIMOSIS FROM GONORRHŒA.	PHIMOSIS WITH SUB-PREPUTIAL CHANCROID.
No history of sore on glans or prepuce.	History of sore.
Swelling in foreskin at first almost entirely œdematous.	Swelling often due to presence of plastic lymph around ulcer.
Discharge usually purulent.	Discharge often sanguinolent.
No definite area more tender or harder than the rest.	A distinct spot usually discoverable by palpation.
Chordee often present.	Never any true chordee.
Ardor urinæ extends along whole length of canal.	Ardor urinæ only when the urine comes in contact with the inflamed or ulcerated foreskin.
Vesical symptoms not infrequent.	No vesical symptoms in uncomplicated cases.
Bubo very rare.	Bubo common.

It is not at all uncommon for patients who have had no experience in venereal disease to assume that a balanitis originating in uncleanliness, and

due to the retention and decomposition of smegma, is a gonorrhœa. In dispensary practice, such patients are usually seen after having passed through the hands of an apothecary who, prescribing, as is usual with such persons, without making an examination, has administered a course of copaiba, sulphate of zinc, etc., in place of the soap and water which were all that was requisite. Of course no such mistake can be made by a careful practitioner; but even he may be temporarily in doubt when the balanitis is complicated with a phimosis so tight as to prevent any view of the meatus. In these cases, however, subpreputial injections are the first essential of treatment in any case, and will soon allay the swelling, so as to permit of sufficient retraction of the prepuce to resolve all uncertainty.

PARAPHIMOSIS, a condition in which the prepuce, retracted and caught behind the projecting corona glandis, cannot be brought forward, is a less frequent but more annoying and dangerous complication. The tense and rather inelastic edge of the preputial orifice constitutes the cause of the constriction, which grows tighter and tighter as swelling increases. The neighboring parts, at first œdematous, soon become infiltrated with inflammatory lymph, the return of blood from the glans is interfered with, and, in extreme cases, ulceration or even extensive sloughing of the head of the penis has occurred, and would doubtless be more frequent were it not for the extraordinary blood supply of the glans, and the anastomosis between its vessels and those of the corpora cavernosa. The line of constriction (see Plate VI. Fig. 3) is situated a short distance behind the glans, *immediately* back of which is a furrow due to the normal depression existing there, intensified by the surrounding œdema. Back of this is a swollen fold of mucous membrane, which is the part of the inner layer of the prepuce, normally in contact with the posterior face and edge of the corona. Then is found a second and very deep furrow, which is the actual seat of the trouble, and behind this another prominent collar of swollen integument. It is attended with severe, sometimes excruciating pain, which does not disappear until either the prepuce has been replaced, or the constriction has been relieved by division or by ulceration. It is often productive of deformity from cicatricial contraction in those cases in which surgical interference has been delayed or ineffective.

These complications—balanitis, balano-posthitis, phimosis, and paraphimosis—are by far the most frequent which make their appearance during this early period of the disease, and have accordingly been described in their usual clinical order. The first stage, or that in which there is a progressive increase in the severity of the symptoms, is of variable duration, but under well-directed treatment commonly terminates in from five days to a week, after which, for a short time, the condition appears to remain stationary.

SYMPTOMS AND COMPLICATIONS OF SECOND OR STATIONARY STAGE.

The discharge is still profuse, and the ardor urinæ and chordee marked, and in some cases agonizing. Patients will complain bitterly that their comfort during the day is interfered with by urgent calls to urinate, which they resist to the last possible moment, in a vain endeavor to avoid the pain occasioned by it; and that their rest at night is disturbed by frequently recurring erections, which are no less painful, and which often will not subside until some means be adopted for their reduction. During this period, which may be said to extend on an average from the seventh or eighth day to the

end of the second week, the inflammation is gradually extending backward, and may give rise to other complications.

FOLLICULAR AND PERI-URETHRAL ABSCESSES.—Dipping down from the urethral membrane into the little mucous follicles which empty upon its surface, the inflammation of gonorrhœa occludes their mouths by causing swelling of their lining membrane, and converts them into little bags or pockets of pus —*follicular abscesses*—which appear as small, round, tender tumors along the under surface of the urethra. They very often open internally, but now and then adhesion to the skin takes place, pointing occurs outwardly, and they discharge upon the cutaneous surface. Fortunately they are not followed by urinary fistulæ. If the suppurative process involves the loose connective tissue around the urethra, a *peri-urethral abscess* is formed. This is most frequent at precisely the points which on *a priori* grounds would have been selected —those at which gonorrhœa is most persistent, the fossa navicularis and the anterior part of the membranous urethra. It is accompanied with localized tenderness and swelling, but on account of the easily distensible nature of the structure in which it is situated, is not very painful. It is a more dangerous complication than the folliculitis, just described, as in rare instances its spontaneous evacuation into the urethra has permitted of extravasation of urine with all its attendant dangers. It is also much more apt to be followed by persistent fistulæ. I have now under my care several cases in which pin-point communication exists between the urethra and the external surface, in the neighborhood of the frænum and near the peno-scrotal junction.

LYMPHANGEITIS.—In a certain proportion of cases of gonorrhœa, a simple *lymphangeitis* occurs as a result of absorption of purulent matter. It affects most commonly the lymphatics of the dorsum of the penis, and has been in my experience almost invariably associated with neglect of cleanliness and retention of the discharge between the prepuce and the glans. This is what might be expected on anatomical grounds from the group of lymphatics involved, those directly connected with the urethra itself belonging to the deeper set, and running beneath the pubic arch to join the deep lymphatics of the pelvis, and to terminate in the lumbar glands.

The *symptoms* consist in a thickened, cord-like line of induration, extending from the prepuce to the root of the penis, usually tender to the touch, easily isolated from the surrounding structures, and often traceable upon the surface by a faint red linear blush. The *dorsal phlebitis* which is said sometimes to occur, is described as associated with more œdematous swelling, and is said to be without the distinct line of induration separable from adjoining parts, and to be unassociated with any enlargement of the lymphatic glands of the groin, which is rarely absent when the lymphatics are involved. I have never seen a case of this character, and believe it to be an exceedingly rare complication of gonorrhœa. The lymphitis of syphilis is unassociated with tenderness, has for its point of origin the initial lesion, and is accompanied by multiple painless indurations of inguinal glands.

BUBO.—Either with or without this condition as a forerunner, adenitis of one of the glands of the groin may be the result of gonorrhœa—or, in other words, we may have a gonorrhœal *bubo*. The gland affected is usually one of the superficial set, lying just below Poupart's ligament, imbedded in the subcutaneous cellular tissue, and above the fascia lata. A small, painful tumor makes its appearance in the groin; it is at first freely movable beneath the skin, but afterwards contracts adhesions to the latter and to the surrounding parts, becomes doughy in feel, and reddish or purplish in hue. In the

majority of cases, after reaching this condition, it will subside under appropriate treatment, disappearing by resolution.   In others, however, particularly in individuals of scrofulous tendencies, or in those broken down by vicious habits or by overwork, suppuration ensues, the connective tissue which surrounds the gland liquefying first.   Indeed, very often the glandular structure itself is not involved in the suppurative action.

Another group of complications may be mentioned as possible occurrences towards the end of the third week, some of them, however, often appearing much later.   They are Cowperitis, Prostatitis, and Cystitis.

COWPERITIS.—Inflammation of one or both of Cowper's glands, or *Cowperitis*, is a result of extension of the urethritis by continuity along their ducts, which empty into the posterior portion of the spongy urethra—that part incorrectly described as the "bulbous" portion.   The first symptom usually developed is pain in the perineum, much increased by pressure, and rendering sitting or walking markedly painful.   The inflammatory swelling of the glands is resisted by the two layers of the triangular ligament between which they are situated, and by the deep perineal fascia, and this resistance, associated with the determination of blood to the part by gravitation, imparts, as in other inflammations where the same conditions exist, a throbbing element to the pain, which renders it peculiarly distressing.   The glands may often be felt as two small hard tumors, situated just back of the scrotum, one on either side of the median line; or may be recognized by pressure made in an upward and forward direction by the finger inserted just within the external sphincter. Urination is difficult if the swelling be great, and is always painful, particularly at its termination, as the glands are surrounded by the transverse fibres of the compressor urethræ muscle—which, contracting to expel the last drops of urine, compresses their inflamed and tender structure.   Suppuration in the peri-glandular tissue sometimes occurs, in which case the usual signs of the formation of pus are present.

PROSTATITIS.—After gonorrhœa has crept or spread backward as far as the prostatic urethra, it may, and in some cases unavoidably does, in spite of the best directed treatment, involve the *prostate gland.*   The follicles and the glandular element of this body are primarily and chiefly affected, the muscular tissue which composes the larger portion of its mass remaining in moderate cases uninvaded.

Harrison, in a paper on acute prostatitis, read at the Medical Society of London, April 11, 1881, divides this affection into two varieties, follicular prostatitis and general or parenchymatous prostatitis, the former attacking the glandular structure, but remaining limited to it, and attended with the symptoms above described ; the other more rare, much more serious, and developing as if the whole gland within the capsule were at once involved in the inflammatory action.   Suppuration usually supervenes, and unless treatment is prompt and decisive, on the first appearance of fluctuation as revealed by rectal examination, the most serious results both as to structure and life are likely to follow.   The persons in whom this variety is said by Mr. Harrison to occur most frequently, are those of deteriorated constitutions, or with urinary organs more or less damaged by long-standing obstructive disease.

The anatomical and physiological relations of the gland (see Fig. 313) furnish at once a key to the symptoms produced by its inflammation, the earliest of which will probably be a feeling of weight and distension in the perineum and rectum.   This is soon followed by frequent urination, due to the inability of the bladder completely to empty itself, the exit of the urine being interfered with by the engorged gland.   The end of the act is painful, but is not

accompanied with the degree of tenesmus which is noticed when the bladder
itself is involved, nor with any marked discharge of pus and blood.   Defe-
cation also is painful, markedly so if the feces are inspissated, and the finger
inserted into the rectum feels the anterior wall pushed into the centre of the
bowel, hot, unnaturally firm, and tender to the touch, while through it the
indefinite outlines of the greatly enlarged prostate can be felt.

<p align="center">Fig. 313.</p>
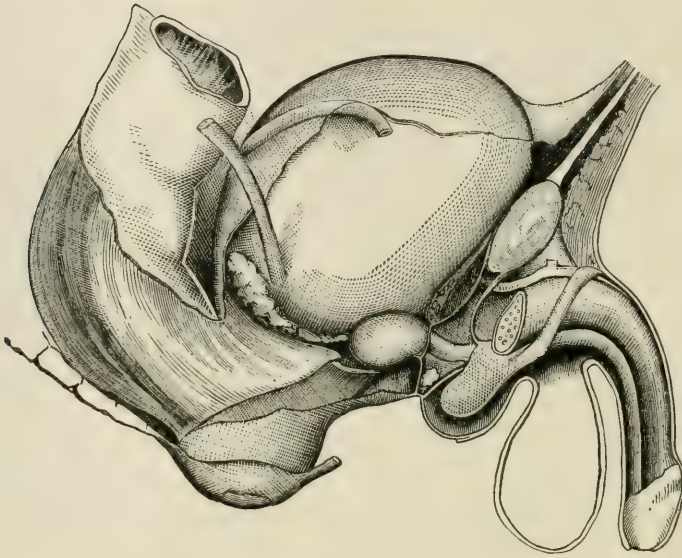
<p align="center">Relations of the prostate to the neck of the bladder and the rectum.</p>

As the disease progresses the pain increases, becomes throbbing, particu-
larly when the patient is erect or in the sitting posture, radiates along the
cords of the hypogastric plexus to all the neighboring regions, and is very
greatly aggravated by any evacuation of the bladder or rectum.   The fre-
quency and difficulty of micturition both increase, the latter sometimes pro-
ceeding to complete retention.

The disease may terminate by resolution, the most frequent way, or by
suppuration.   In the former event, the symptoms gradually subside, and the
urethral discharge, which has been replaced during this period by the albu-
minoid secretion of the prostate, reappears and is often profuse.   If suppura-
tion occurs, it is usually due to the coalescence of several inflamed follicles,
which, lying in proximity to one another, have broken down into a common
cavity.   The pus is frequently discharged into the urethra, but occasionally
pointing takes place in the direction of the rectum.   In either event, evacua-
tion gives great relief.

In most cases, the prostate is left with some fibrous thickening—a hyper-
plasia of its cellular tissue—which is often the groundwork for future trouble,
but which should not be confounded with the hypertrophy of the same tissue

and of the muscular elements, which so frequently takes place in advanced life.[1]

An acute prostatitis may run into a chronic condition which is very annoying and intractable. The same symptoms exist in a modified and much subdued form; the pain is replaced by a sense of weight and fulness; micturition is rather too frequent, and is feeble, the last drops dribbling from the meatus; a mucoid discharge like the white of raw egg, but occasionally milky, may be squeezed from the urethra by deep pressure from behind forward, and the same discharge appears at the meatus after every evacuation of the rectum. By examination through the latter, the gland is found to be somewhat enlarged, and slightly tender on firm pressure.

As it is desirable in this as in some other cases, hereafter to be described, to ascertain the character of the discharge and also the exact locality of the inflammation which furnishes it, it may be well to have recourse to a bulbous bougie, it being remembered that in this condition the acute symptoms have subsided, and that there is but little danger of re-kindling the urethritis. The bougie, the head of which should be large enough comfortably to fill the urethra, should be passed down to the junction of the spongy and membranous portions, and then withdrawn. If it bring with it, as it probably will, some muco-pus from the anterior part of the urethra, this should be wiped off, and the instrument again inserted as far as the neck of the bladder. On removing it, a quantity of the prostatic secretion will usually be found upon the shoulder of the bulb. Pain is generally excited by the contact with the instrument, and the degree of sensitiveness will furnish a valuable indication for treatment, and should be carefully observed.

The mental symptoms associated with this trouble are often the most distressing. They will be alluded to again when we come to consider the sequelæ of gonorrhœa.

Cystitis.—A greater or less involvement of the neck of the bladder is often a concomitant of acute prostatitis, and is indicated by increased urinary trouble and by the appearance of a drop or two of blood at the end of micturition. This *prostato-cystitis*, which is the form of bladder trouble usually encountered in gonorrhœa, may subside under treatment, or may pass into a well-developed inflammation of the mucous membrane of the vesical neck. In this case (*Gonorrhœal Cystitis*), we have certain well-marked symptoms, chief among which are very frequent urination, the patient not being able to retain his water for more than a few moments, and the desire to expel it becoming intense and irresistible on the slightest delay; excessive vesical tenesmus at the end of the act, which is characterized by severe burning pain instead of a sense of relief; blood and pus following the stream of urine, the latter part of which is turbid or milky. There are few constitutional symptoms, little or no fever, no rigors, and but slight deterioration of the general health unless the disease runs a protracted course. The diagnosis between prostatitis and cystitis, which are the only complications of gonorrhœa likely to be confounded, may be made by attention to the following points:—

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[1] "Zeissl believes that in every case of chronic gonorrhœa there is moderate tumefaction of the prostate. Individuals who have very frequently had gonorrhœa, or in whom gonorrhœa has persisted for a long period, are said to be the subjects of a considerable enlargement of the prostate in their thirty-fifth year or even younger, the growth being due to the persistent hyperæmia of the part during the prolonged urethritis." Among 2041 cases of gonorrhœa admitted into the Antiquaille Hospital of Lyons, under the care of Dron, prostatitis occurred only three times. (Hill and Cooper, op. cit., p. 530.) This is certainly an unusually small number, and in all probability must have been due to a failure to recognize the disease, or to its classification under some other name.

PROSTATITIS.	CYSTITIS.
Not as frequent a complication of gonorrhœa as a mild form of cystitis.	Occurs in its lower grades in perhaps one-fourth of all cases of gonorrhœa.
Perineal and rectal pain.	Possibly a little tenderness of perineum on pressure, but no rectal pain.
Pain violent and throbbing, aggravated during defecation.	Pain burning, not especially affected by defecation.
Pain not markedly severe at the end of urination.	Much pain in passing the last drops of urine.
Tenesmus not always present.	Tenesmus constant and severe; very characteristic.
Stream of urine diminished in size.	Size of stream not always affected.
Retention of urine common.	Retention of urine rare.
Urine not much changed in appearance.	Urine turbid and ropy, last drops mixed with blood.
Rectal examination shows enlargement and great tenderness of the prostate.	No prostatic enlargement or tenderness recognizable by rectal examination.

Two conditions are said by Mr. Reginald Harrison closely to simulate acute prostatitis, the first being inflammation and suppuration *around* the membranous portion of the urethra as a consequence of urethritis; and the second, inflammation and plugging of the veins constituting the prostatic plexus. The diagnosis between the former condition and prostatitis should be made chiefly by the situation of the swelling, which here will be perineal, while in inflammation of the prostate it is difficult to imagine how the tumefaction can invade the region of the perineum. It certainly does not become apparent there when the prostate is hypertrophied in old age. When suppuration occurs, the pus may be discharged by a perineal opening, when it arises from a peri-urethritis; it never is so in prostatitis.[1]

The other disordered condition is said to be rare. Mr. Harrison, who has only seen two cases of it, describes the primary lesion as œdema of the prepuce dependent upon plugging of the dorsal vein of the penis. In both cases a feeling of perineal weight, frequent micturition, and uneasiness referred to the neck of the bladder, come on in a few days. Rectal examination is said to have determined that these symptoms were not due to any inflammation of the gland, but to the extension of the vein-blocking to the prostatic plexus.

I have never seen such cases, and do not believe that digital examination *per rectum* will disclose with any definiteness the condition of the veins said to be involved. On the other hand, a follicular prostatitis not extending to any depth from the urethra, will often give rise to no general tumefaction of the gland, and to little or no tenderness on rectal pressure, while at the same time it would produce all the above-mentioned symptoms. Probably autopsies alone can determine the existence or non-existence of this alleged prostatic phlebitis.

These complications belong in the majority of cases to the latter part of the *stationary* period of gonorrhœa, which extends over from one to two

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[1] The points of similarity between the two conditions are very marked: "In both there is a cessation or alteration in the character of the urethral discharge; in both there is a feeling of weight and uneasiness about the perineum; in both there is some difficulty in micturition, perhaps amounting to retention; and in both there is some tumefaction to be felt, and much distress is occasioned on introducing the finger into the rectum. So painful is the latter to the patient that it often leads to an imperfect examination being made, and hence an error of diagnosis arises in exactly fixing the position of the tumefaction, which might have been avoided." (Medical Times and Gazette, July 2, 1881.)

weeks, rarely longer, and during which the acute symptoms of the first stage, the ardor urinæ, chordee, etc., remain, as has been said, nearly or quite unaltered.

At the termination of this stage that of *subsidence* begins, and in uncomplicated cases progresses rapidly until complete recovery has taken place.

Symptoms and Complications of Third Stage, or that of Subsidence.

Urination becomes painless and less frequent; the discharge grows thinner, becomes watery and scanty, or dries up altogether; erections no longer occur with abnormal frequency, and do not give rise to curvation of the penis or to pain. If any of the complications which have been described has existed, the last vestiges of it fade away, and perfect health is restored.

But until this stage is actually completed, as long as any of the symptoms of urethritis are still evident, there are yet certain dangers to be avoided, and serious difficulties which may present themselves.

Epididymitis.—Chief among these, in respect to frequency of occurrence, is *epididymitis*, or swelled testicle, which is a complication usually supervening in the fifth or sixth week of the disease, sometimes coming much earlier, and rarely as late as the end of the second month, or even in the third month. In the great majority of instances it is obviously the result of the extension of the urethral inflammation along the ejaculatory ducts and spermatic canal to the epididymis itself.[1] In others this connection between the original inflammation and the epididymitis is not apparent, and various theories have been adduced to explain the phenomenon.[2] The sympathy existing between the various portions of the genito-urinary system, metastasis, reflex nervous agency, and other hypotheses, are all unsatisfactory, and, as it seems to me, unnecessary. The absence of conclusive post-mortem or clinical proof that the vas deferens is the medium of transmission in almost every case is readily understood when we remember, on the one hand, that the deaths which occur during this stage are from intercurrent diseases, and are very rare, and, on the other hand, that it is not at all uncommon for inflammation to travel rapidly, leaving behind it no foot-prints, over extensive mucous surfaces.[3]

If the disease were metastatic in its origin, or the result of "sympathy" or of reflex irritation, it is difficult to see why it should stop at the epididymis, which is an excretory duct and a comparatively unessential part of the testicle, and should spare the secretory portion of that gland. The early symptoms usually indicate more or less clearly the course of the disease, and, indeed, the clinical evidence, and the period at which the affection develops

[1] M. Terrillon asserts (Le Progrès Médical, Jan. 29, 1881) that in swelled testicle the inflammation is principally in the cellular tissue around the epididymis, rather than in that organ itself.

[2] Dr. Otis, in a clinical lecture on epididymitis (Boston Medical and Surgical Journal, Nov. 28, 1878), after calling attention to its association with strictures of large calibre, adds: "Such strictures are capable of producing recurring epididymitis of every grade, from that which causes slight swelling and tenderness to the most acute form of the trouble. My own observation leads me to believe that the lighter forms of trouble, such as chronic sensitiveness and occasional slight swelling, also various grades of hydrocele, are the result of reflex irritation transmitted from a point of stricture, and that the attacks of acute epididymitis are due to the extension of the inflammation—the urethritis associated with stricture—along the track of the vas deferens, as in epididymitis accompanying ordinary gonorrhœa."

[3] In 1871, MM. Gombault and Terrillon made an autopsy in the case of a young man, aged 19, who died of an intercurrent disease during an attack of gonorrhœa. They found the vas deferens, in its entire extent, filled with the products of catarrhal inflammation, red, swollen, and injected; no epididymitis had yet developed.

in the great majority of cases, when taken in conjunction with the evidence obtained by experiment, are quite sufficient to explain the production of the epididymitis in the manner indicated. The first symptom which attracts the attention of the patient is an aching, occasionally a neuralgic pain, along the line of the groin, more frequently on the left side.[1] If the cord be taken between the thumb and finger at this time and rolled gently so as to separate its constituents, the vas deferens will be found enlarged usually to but a slight degree, but sometimes to three or four times its normal diameter; it will also be tender on pressure.[2] Sometimes, but rarely, it will be insensitive, and in this event, in many cases, the inguinal pain will prove to be simply neuralgic in its character, and no further trouble will result. If the inflammation progresses, however, and the epididymis is involved, this preliminary pain is soon followed by a feeling of weight and a dull ache in the affected testicle, which begins to increase in size and rapidly becomes of great bulk, purplish in color, and exceedingly painful.[3] (See Plate VII. Fig. 1.) The nauseating quality possessed by this pain is peculiar to it, and serves greatly to aggravate its unpleasantness.

The patient, particularly if the testicle be not supported so that its weight is withdrawn from the cord, will walk in a slightly stooping posture, with the legs apart—a straddling, constrained attitude which is almost pathognomonic of this ailment. The dragging of the heavy tumor upon the spermatic vessels prevents the free return of blood from the testicle and serves to increase the tension, and by additional pressure upon the nerves to add to the pain, which in some instances spreads by reflex agency to the loins, abdomen,

[1] Jullien has collected 2158 cases of epididymitis, of which 1011 were on the right side, 982 on the left, and 165 double. (Maladies Vénériennes, p. 104.) " Of 1342 cases observed by Sigmund, of Vienna, the *left* testicle was affected in two-thirds." (Bumstead and Taylor, Treatise on Venereal Diseases, p. 133.)

[2] M. Terrillon (Bull. de la Soc. de Chirurgie, 1881, No. 2) details four different degrees of inflammation of the vas deferens observed when the disease is experimentally excited : (1) Mucous membrane alone attacked ; (2) More frequently muscular walls also involved ; (3) Cellular tissue of spermatic cord affected ; (4) General connective tissue and scrotum inflamed. He thinks that the sole theory of epididymitis which is at all tenable is that which ascribes it to propagation of the inflammation along the ejaculatory ducts and the vas deferens.

[3] In exceptional cases, a patient with gonorrhœa having a complete inguinal hernia, or having accidentally received a blow on the scrotum, may develop a painful tumor of the scrotum, about the diagnosis of which some difficulty will exist. The following table of Mr. Christopher Heath very well represents the differences between the gonorrhœal complication and the other diseases for which it may be mistaken :—

STRANGULATED HERNIA.	HÆMATOCELE.	ORCHITIS OR EPIDIDYMITIS.
Suddenly produced, or, if present before, suddenly strangulated ;	Suddenly produced by some external violence ;	Developed a few hours after a blow or following gonorrhœa ;
Pain in groin and about abdomen, with considerable constitutional depression and anxiety of face ;	Pain in scrotum and constitutional disturbance, slight after the first few minutes ;	Pain in scrotum and along the cord to the loins ; feverish disturbance of system ;
Tumor tense, and giving the sensation of intestine when manipulated ; skin normal ;	Tumor tense and heavy, globular in shape, and not translucent ; skin often bruised ;	Tumor excessively tender to the touch ; cord thickened ; skin reddened ;
Impulse on coughing to be felt along the groin, in which there is more fulness than usual, but ceases abruptly at the point of strangulation ;	No impulse in groin, which is perfectly normal.	No impulse on coughing ;
Percussion over tumor gives a clear sound unless the protrusion is omental ;	Percussion gives a dull note ;	Percussion gives a dull note ;
Vomiting probably present, continuous, and eventually stercoraceous.	Vomiting immediately following the accident, but not continued.	Nausea and faintness, but seldom vomiting.

PLATE VII.
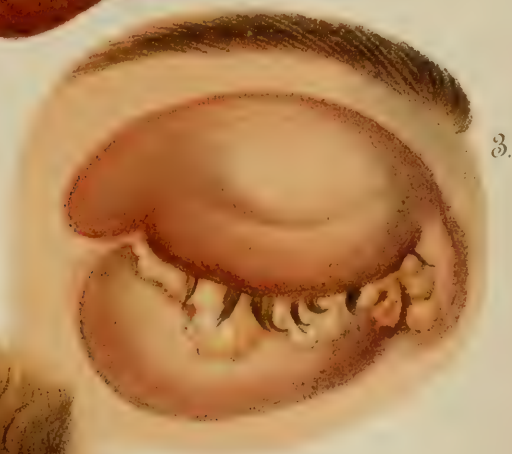
1 Epididymitis.   2.3 Gonorrhœal Conjunctivitis.
4 Vulvo-vaginal Abscess.

thighs, and even the thoracic region, and is almost unbearable. There are usually more or less febrile disturbance, and great mental anxiety and depression. Under proper treatment, the acute inflammatory symptoms subside by resolution in a few days, but the enlargement disappears very gradually, a small portion of the globus minor often remaining perceptibly indurated throughout life. In neglected cases, the testicle proper becomes involved, which may be known by an increase in the size and density of the tumor, by the uniform diffusion of the swelling, which can no longer be outlined at the back of the scrotum, by the unusual tenderness on pressure, and by the persistence of the pain, nausea, etc., in spite of such treatment as usually gives relief.[1]

In a still smaller number of cases, suppuration occurs in the subcutaneous cellular tissue, and sometimes involves a large portion of the scrotum. These terminations of epididymitis result, as a rule, from improper treatment, or are found in the broken-down and intemperate subjects of hospital or dispensary practice. Of the numerous sequelæ said to follow swelled testicle, I have seen very few instances. A lingering tenderness in the region of the epididymis is quite common, but true neuralgia of the testicle, with its agonizing pain, must be very rare, as I have never met with a single instance of this condition to which epididymitis seemed to have any definite causative relation. It is unquestionable that persistent induration of the globus minor, which consists of a single tube for the passage of semen, may interfere with or entirely prevent the exercise of its function, and that if both testicles have been involved, sterility more or less permanent may result. There may be, however, and usually are, all the indications of virility; there is no diminution in desire, nor in ability to perform the sexual act, which is accompanied by emission of fluid derived chiefly from the prostate and the seminal vesicles, and which is attended by the customary amount of pleasure. In other words, the patient, though sterile by reason of the absence of spermatozoa from the fluid which he emits, is not by any means impotent. Time and suitable remedies will often remove this condition, at least to a degree which permits of the reappearance of small numbers of spermatozoa in the semen, and consequently restores to the patient his ability to beget children. The prognosis in this respect should be guarded.[2]

That the left testicle is affected twice as often as the right, is usually attributed to the fact that as a rule it hangs lower, and thus receives less support from the scrotum. It is more probably, however, the result of the position of the left spermatic vein behind the sigmoid flexure, where it is especially subject to obstruction by pressure, and also of its indirect communication with the vena cava through the renal vein, which it enters at a right angle, the right spermatic vein emptying into the cava at an acute angle. The left spermatic vein is also unprovided with a valve at the point of entrance into the renal vein. These causes are sufficient to produce local congestion, a powerful predisposing cause of inflammatory attacks. As a result of pressure on the efferent vessels by inflammatory products, or as a consequence of extension of the inflammatory action itself, *acute hydrocele* may and often does complicate epididymitis, adding to the size of the swollen

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[1] Sigmund (quoted by Hill) found that, in 1342 cases, the epididymis was alone affected in 61; the epididymis and cord in 108; the epididymis and tunica vaginalis in 856; and all three parts in 317. Of Dron's 726 cases, the body of the testis was affected in only ten; and of Hardy's 226 cases, the inflammation attacked the testis proper in but nine.

[2] Gosselin, Curling, Liégois, Godard and Terrillon, Hill, Bumstead, Lebert, and others all coincide in the belief that double epididymitis is, in the great majority of cases, followed by sterility, or the absence of spermatozoa from the semen, and that there is very little probability of entire recovery. In 117 cases of this character, which I have been able to collect from various sources, only thirteen were recorded as experiencing any improvement from treatment.

organ and increasing the feeling of tension to both the patient and the surgeon. It requires no special treatment, and usually subsides when the declining stage is reached.

PYÆMIA, as a sequence of gonorrhœa,[1] and PELVIC CELLULITIS, following the extravasation of urine resulting from the rupture of a gonorrhœal periurethral abscess, are possible accidents, and in spite of their extreme rarity should be borne in mind in the management of these cases. PERITONITIS is also, as might be supposed, of very exceptional occurrence. I have seen this complication in one case, of which the following is a brief *résumé* taken from my case book:—

R. K., aged 23, suffering with his first attack of gonorrhœa, was in the second week of the disease and progressing favorably when he suddenly felt pain in the groin and along the track of the cord, which led me to believe that he was about to develop an epididymitis. Instead, however, of the testicle swelling, the pain and tenderness spread from the right groin over the surface of the abdomen, which soon became tense, almost tympanitic, and sensitive to the touch. From this time onward he manifested all the symptoms of acute peritonitis, which for some days endangered his life, and which required the usual treatment. Dr. H. C. Wood saw him with me at this time. During the subsidence of the peritonitis, a low grade of epididymitis occurred. The most interesting point about the case was the discovery that the patient had previously had a small congenital hydrocele which, as it could be returned into the abdomen, had at one time evidently been carelessly mistaken for a hernia, a truss having been applied by order of a physician. This explained very clearly the etiology of the case, the communication between the peritoneal cavity and the tunica vaginalis, through the funicular process, being uninterrupted, and permitting of a ready extension of the inflammation from the vas deferens, through the surrounding cellular tissue, to the peritoneum. Some weeks after complete restoration to health, no trace of the affection was discernible.[2]

The foregoing complications are chiefly, although not exclusively, met with in gonorrhœas of the first or acute inflammatory variety.

We may now consider that form of gonorrhœa which has been designated as *subacute* or *catarrhal.*

SUBACUTE OR CATARRHAL GONORRHŒA.

This occurs most commonly in persons who have had previous attacks of gonorrhœa, and is an example of the tendency manifested by all mucous structures to take on inflammation upon slight provocation after having once been affected. It is particularly noticeable in the urethra for several reasons: the canal affords periodical passage to a secretion, the urine, which is especially liable, by reason of changes in its constitution, to become an actual irritant; it is exposed, at times of erection, to intense congestion of all its vessels, and the converse is also true, a congested or irritated spot along the

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[1] Hill and Cooper quote (op. cit. p. 546) three fatal cases of pyæmia, in all of which there was phlebitis of the prostatic plexus. In all of them also the urethral mucous membrane was intact. Agnew reports a fatal case (Principles and Practice of Surgery, vol. ii. p. 468) occurring in an exceptionally robust man.

[2] A few cases are recorded in which peritonitis occurred as a complication of epididymitis. In the majority of them, however, the connection between the two diseases is not satisfactorily demonstrated. Dolbeau and Terrillon have each reported a case in which fatal peritonitis followed gonorrhœal epididymitis affecting an undescended testicle. MM. Godard, Peter and Gosselin have published cases in which the spread of the inflammation along the spermatic cord to the abdomen, and thus to the peritoneum, was demonstrated by post-mortem examination.

urethra predisposing to erection; gravitation, the proportionately excessive supply of blood to the region, and the absence of extra-vascular resistance due to the loose character of the spongy tissue, all favor the persistence of any vascular enlargement or congestion left after a first attack of urethritis; the condition of approximation of the mucous surfaces, as of the urethral walls during the intervals of micturition, is here as elsewhere unfavorable to the disappearance of granular or injected areas, or other traces of inflammation. For these and other reasons, among the immense number of young men who have had gonorrhœa once, comparatively few escape subsequent manifestations, a predisposing cause being usually present, although some additional irritant such as contact with menstrual fluid, or with a leucorrhœal secretion, is generally necessary to bring on marked symptoms.

A patient with this variety of urethritis will present himself to the surgeon at a variable time after a suspicious or an unaccustomed connection, with a free, muco-purulent or purulent, urethral discharge. He will complain of very little pain, possibly only of a sensation of warmth during urination, or there may not be the least alteration of sensibility. Chordee is absent or very slight, there is no vesical irritability, and the complications which have been detailed are exceedingly infrequent. The only affection for which this form of gonorrhœa is likely to be mistaken is urethral chancre, the possibility of which should never be forgotten.

The diagnosis between infecting chancre of the urethra and gonorrhœa may be made by attention to the following points:—

URETHRAL CHANCRE.	URETHRITIS.
Symptoms appear after a period of incubation rarely less than ten days, often two or three weeks.	Symptoms follow suspicious intercourse in from twenty-four hours to a week, rarely at a longer interval.
Confined to meatus or its immediate neighborhood.	Begin at meatus but extend some distance backward.
Ardor urinæ felt only at lips; no chordee.	Ardor urinæ felt along the urethra; chordee often present.
Discharge moderate, never purulent, often bloody.	Discharge more profuse, decidedly purulent,[1] not so often or so largely stained with blood.
Induration perceptible to touch, usually involving only one lip of meatus.	No induration.
Invariable enlargement of chain of inguinal lymphatics, which are painless and freely movable, and almost never suppurate.	If lymphatics are involved at all, only one is affected, which often goes on to suppuration.
Sore can almost always be seen as a loss of continuity of mucous membrane.	No loss of continuity perceptible.
Constitutional symptoms follow after from six to eight weeks.	No constitutional symptoms.
Use of syringe painful at meatus.	Use of syringe not usually painful.

Under treatment, the discharge rapidly diminishes, until only a drop or two of muco-pus can be seen, and that chiefly in the mornings. This symptom is apt to linger in spite of all efforts to remove it, and is perhaps

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[1] Dr. J. Nevins Hyde states very positively that "when a man exhibits a decidedly purulent urethral discharge, without coincident symptoms of unmistakable syphilis, he can be safely pronounced free from all danger of the last-named disease, provided always the period of incubation of syphilitic chancre has, in his history, already elapsed. Intra-urethral chancre need therefore never be mistaken for gonorrhœal disease, as the two affections are so distinct that a differential diagnosis can usually be satisfactorily established without the aid of the endoscope." (Chicago Medical Journal, August, 1880.)

the most persistent, and by reason of its long continuance the most annoying, consequence of this form of gonorrhœa.

There are, however, some complications which, although they may likewise appear during an acute attack, are often associated with this catarrhal condition of the urethra, and which are of considerable gravity. These are gonorrhœal rheumatism, gonorrhœal ophthalmia, and gonorrhœal conjunctivitis.

Complications of Catarrhal Gonorrhœa.

Gonorrhœal Rheumatism, or Urethral Synovitis, as it has been better called, may appear at any time during the existence of a purulent discharge from the urethra. It is much more common in men than in women. It develops suddenly, and is usually accompanied by some abatement of the discharge, more rarely by its entire disappearance. The disease has been ascribed to various causes—metastasis, reflex agency, identity of gonorrhœa and syphilis, development of a pre-existing rheumatic diathesis, and, finally, a mild form of septicæmic infection.

The majority of these hypotheses are untenable. If the disease were due to metastasis, the original affection should disappear, but, as has been said, this is only of exceptional occurrence; if it were a result of reflex action, other forms of genital irritation, balanitis, phimosis, etc., should produce it, but this is not the case. That it is not an evidence of the identity of gonorrhœa and syphilis, has been proved by inoculation, and is evident from the fact that it often follows traumatic urethritis; this view is hardly worthy of formal refutation. There is often no discoverable connection between this form of rheumatism and any tendency, hereditary or acquired, to rheumatic disease; my own experience has amply convinced me of this fact. Besides, as will be seen, there are broad distinctions between this disease and ordinary rheumatism.

We have remaining, then, the theory of septicæmia, which there are several reasons for favoring. If the joint troubles do result from the absorption into the blood of septic matters arising from pus decomposition, we can understand the otherwise mysterious fact of their much greater frequency in the male than in the female, the length, narrowness and delicacy of the male urethral canal offering admirable opportunities for the retention, decomposition and absorption of purulent matter, as contrasted with the short urethra of the female, or with the thick, resistant, non-absorbent, vaginal mucous membrane. We can also understand the obstinacy of this affection under ordinary anti-rheumatic treatment; its occurrence by preference in those cases in which long-continued suppuration has given the best chances for absorption to take place; its appearance with successive attacks of gonorrhœa, no rheumatic symptoms being noticed in the intervals; its variations from the course of common rheumatism—its predilection for one particular joint, etc.—so that it seems safe to say that, although not absolutely proved, the septicæmic theory is probably the correct one.

Dr. Wilks believes that gonorrhœal rheumatism is usually a subacute form of pyæmic inflammation. He considers it analogous to scarlatinal rheumatism, which is often nothing less than severe pyæmia, traceable to purulent infection from the sores in the throat; he also compares it to puerperal rheumatism, and to that form which sometimes follows smallpox. In support of the pyæmic origin of gonorrhœal rheumatism, Wilks refers to two cases in which obscure fatal pyæmia proved to have for its cause a gonorrhœal inflammation of the urethra, the evidence of this being the discovery of a purulent inflammation of the prostatic plexus of veins while the urethra was full of pus.

Dr. Da Costa says, in a clinical lecture, " This case demonstrates what I am in the habit of teaching, that gonorrhœal rheumatism is, in truth, a form of pyæmic rheumatism, involving special features, and requiring special treatment."[1]

Senator considers that the most probable explanation is that the inflammatory irritation is gradually propagated from the urethra to the sacral plexus and the spinal cord, where it affects trophic nerve fibres. Gonorrhœal urethritis would thus be assimilated to those articular disorders which occur in diseases of the spinal marrow.[2]

Agnew teaches that it is septicæmic in its character.[3]

The *symptoms* of this complication come on rapidly, usually during the later stages of either an acute or catarrhal gonorrhœa. The patient, without any premonitory signs, or perhaps after a slight chill or " creep" and a little febrile disturbance, notices pain and swelling in an articulation, commonly the knee, ankle, wrist, or elbow, in order of frequency.[4] Within a few hours the swelling, due to synovial exudation,[5] increases, the joint becomes moderately red and hot, and very tender, the suffering on touch or movement being great. It may remain in this condition for some time, may involve neighboring tissues, producing a general arthritis, or may in a very few cases subside rapidly. There are few if any constitutional symptoms.

The disease in a certain number of cases only develops vague travelling pains in joints, bones, and muscles, and does not produce well-marked local symptoms.

" In the Archives Générales de Médecine for May, 1881, MM. Duplay and Brun discuss a form of gonorrhœal arthritis which, according to them, has not before been fully described. This variety of arthritis may come on suddenly, without any known immediate cause, or it may follow slight injury. Most frequently, however, it is preceded by malaise, slight fever, loss of appetite, etc. The first symptom is pain, which comes on with great acuteness. The pain begins, and is always worst, just at the spot where the articular surfaces of the bones touch each other, and is increased at night. Besides this spontaneous pain, acute suffering is caused by pressure above the joint. Swelling soon follows the pain, and it also first appears exactly at the line of junction of the bones which form the joint. There is little or no effusion into the synovial cavity, the swelling being chiefly due to infiltration of the periarticular tissues. The œdema extends above and below the affected joint, and sometimes there is an obscure kind of fluctuation, leading to a suspicion of abscess. Two cases are mentioned in which incisions were made under this belief. The swelling is not due to effusion into the sheaths of the tendons. In the treatment of this form of arthritis, the most important point is absolute rest of the joint by means of a plaster-of-Paris bandage. The pain then soon disappears, and, in favorable cases, the joint recovers almost entirely. If, however, the joint be not fixed until several days after the onset, more or less stiffness is likely to remain; and if the affection be neglected altogether, anchylosis will probably occur; indeed this sometimes happens in spite of careful treatment. The wrist and the elbow appear to be the joints most frequently attacked, while the knee, which is frequently the seat of the effusive form (hydrarthrosis), is comparatively seldom involved. However, any joint may suffer, and the authors have seen marked examples of this form of arthritis in the metacarpal, phalangeal, and sterno-clavicular articulations. But whatever joint is attacked, the symptoms are essentially those which have just been described. The paper concludes with notes of six cases (three of the

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[1] College and Clinical Record, July 15, 1881.
[2] Ziemssen, Cyclopædia of Practical Medicine, vol. xvi. p. 73.
[3] Op. cit. vol. ii. p. 474.
[4] In one hundred and twenty cases of gonorrhœal rheumatism tabulated by Fournier, the whole number of joints affected was two hundred and twelve: the knee eighty-three times; ankle, thirty-two times; fingers and toes, twenty-five times. He divided the diseases into three varieties: (*a*)A monarticular hydrarthrosis; (*b*) A more generalized affection resembling ordinary rheumatism, but more stationary and protracted, less mobile, unattended with marked constitutional symptoms, etc.; (*c*) Vague general pain without much structural alteration.
[5] M. Gosselin says, " It is very rare that we find exudation in an articulation in consequence of a blennorrhagic arthritis." (Gazette des Hôpitaux, No. 17, 1881.)

patients being women), illustrating the various points already mentioned ; the chief features of this form of joint-affection are the occurrence of pain and swelling, which always begin and remain most marked exactly at the interarticular line, the presence of crackling, and the liability to anchylosis if the joint be not fixed early."[1]

Ordinary rheumatism is the only disease for which this form of joint affection is likely to be mistaken. The diagnosis should be based upon the following points which, for convenience sake, may be tabulated thus :—

GONORRHŒAL RHEUMATISM.	ORDINARY RHEUMATISM.
Associated with urethritis.	Not associated with urethritis.
Very infrequent in women.	Not very rare in women.
Constitutional symptoms transient and not severe.	Constitutional symptoms marked and prolonged.
Very little fever.	High fever.
No sweating.	Profuse sweating.
Urine unaltered.	Urine high-colored and loaded with urates.
Often associated with sclerotitis, bursitis, and teno-synovitis.	Not complicated with sclerotitis, bursitis, or teno-synovitis.
Cardiac lesions rare.[2]	Cardiac lesions frequent.
Inflammation remains fixed; involves one or a few joints.	Inflammation jumps from one joint to another, involving many.
Local pains rather less than in true rheumatism.	Pains always severe.
Effused fluid is absorbed very slowly.	Effused fluid absorbed with comparative rapidity.
Tendency to hydrarthrosis after acute stage has passed.	No tendency to chronic hydrarthrosis.
Great tendency to relapse during subsequent gonorrhœas.	Relapses have no association with urethral conditions.
Anti-rheumatic remedies are unavailing.	Anti-rheumatic remedies are evidently useful.

The *sciatica* which is described as often associated with gonorrhœal rheumatism, is in all probability a symptom of involvement of the hip-joint, although here, as in many other cases, the diagnosis between commencing arthritic trouble and an inflammation of the fibrous sheath of the nerve is well nigh impossible.

The varieties of gonorrhœal rheumatism, other than that described, have been classified into the *arthritic*, in which the swelling, instead of depending upon the presence of effusion into the synovial sac, or *hydrarthrosis*, is due to a thickening of the capsular and subcutaneous tissues of the articulation ; the *arthralgic*, in which the swelling and inflammation are slight, and the pain is rather neuralgic in character ; and the "*knotty, or pseudo-gouty*," in which the phalangeal joints become enlarged and distorted. The first of these has always, in my experience, been preceded by a synovial effusion, and has been the result of protracted continuance of the joint trouble. I have never met with the last variety, and must be permitted to doubt its existence as a complication of gonorrhœa.

GONORRHŒAL OPHTHALMIA AND GONORRHŒAL CONJUNCTIVITIS.—Associated with these joint troubles in many cases, or occasionally occurring as the only

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[1] London Medical Record, October 15, 1881.
[2] Dr. Pfuhl reports (Deutsche Zeitschrift für pract. Med., No. 50, 1878) seventeen reliable cases of endocarditis following gonorrhœa, and adds one to the number. Dr. Cianciosi also records a similar case (Bullet. dell. Scienz. Med., Sept. 1880). Examples of gonorrhœal endocarditis have also been noted by La Cassagne, Désnos, Marty, and Baudin.

complication of a urethritis, there is an inflammation of some of the structures of the eye, known as *Gonorrhœal Ophthalmia*. The sclerotic coat, the iris, and the oculo-palpebral conjunctiva, are the tissues chiefly affected—the symptoms being those of a common iritis or conjunctivitis, attended with considerable aching pain, and accompanied by only a moderate amount of muco-purulent discharge. The usual remedies have a beneficial effect, but the disease tends to run a rather chronic course, and finally to subside spontaneously.

This complication should not be confused with the very different and much more serious condition of *Gonorrhœal Conjunctivitis*, although they are often spoken of as identical. The latter trouble is a result always of direct inoculation, the pus being transferred by the finger or otherwise to the edge or inside surface of the lids. The symptoms commonly make their appearance within a few hours, and are at first like those of a simple catarrhal conjunctivitis. They increase, however, with almost incredible rapidity, so that an eye which twenty-four hours previously was entirely healthy, will be found with tense, swollen, œdematous, bulging, erysipelatous-looking lids, from between the closely-approximated edges of which a thick purulent secretion is oozing; on separating them the conjunctiva is found injected and chemosed, and bathed in pus. In a short time, if the chemosis is not relieved, the supply of blood being cut off from the cornea, the latter ulcerates in one or more spots, or may become detached and fall out entirely, permitting a complete loss of the contents of the globe. This whole series of phenomena may occur within three or four days, and not infrequently has occupied only half that time. The pus from such an inflammation is intensely contagious, irritates the cheek over which it flows, and will, to a certainty, affect the sound eye if any be allowed to come in contact with it. (See Plate VII. Figs. 2, 3.)

It is of great importance that, from the very onset of the disease, it should be distinguished from the mild, self-curable affection which we have described. The main points of difference are contained in the following table:—

GONORRHŒAL CONJUNCTIVITIS.	GONORRHŒAL OPHTHALMIA.
Produced by contagion only.	Produced probably by septicæmic infection. Has no relation to direct contagion.
Occurs once in seven hundred or eight hundred cases of gonorrhœa.	Occurs once in fifty or sixty cases.
May be derived from a second person by pus inoculation.	Can only occur in a patient having urethritis.
Involves one eye primarily.	Involves both eyes usually.
Remains limited to eye originally affected, unless the other is accidentally inoculated.	Frequently passes from one eye to the other.
Symptoms affect the conjunctiva from the start.	Symptoms affect the fibrous tissues, the sclerotic coat, and iris.
Symptoms of greatest gravity and urgency.	Symptoms mild, subacute.
No association with subsequent gonorrhœa.	Frequently returns with each later attack of gonorrhœa.
No relation to joint troubles, or other rheumatic manifestations.	Most commonly found to coexist with some other form of gonorrhœal rheumatism.
Tendency to rapid destruction of tissues involved.	Tendency to final but slow cure.
Treatment very useful; should be prompt and energetic.	Treatment not very effective; should be mild and expectant.

This form of conjunctivitis does not differ in any of its essential features from *Ophthalmia Neonatorum*, or from the ophthalmia which has been artifi-

cially produced by inoculation of purulent secretions, and, as has been said, affords therefore no evidence of the specific nature of gonorrhœa.

The treatment of this, together with that of all the complications that have been detailed, will be described hereafter.

Irritative or Abortive Gonorrhœa.

There remains to be considered the third variety of so-called " gonorrhœas," the *irritative*, or "abortive." Not infrequently after a suspicious connection, a variable interval having elapsed, a patient will present himself complaining of a slight stinging pain on urination, and a little itching or tingling at the meatus. An examination discloses a slight reddening, possibly a little swelling of the lips of that orifice, and a little transparent or very moderately turbid secretion coming from the anterior half-inch of the urethra, and only made to appear at the meatus by firm pressure from behind forward. These symptoms are very similar to those of the earliest stage of an acute ure-thritis, and indeed are altogether indistinguishable from them, a fact of importance in deciding as to the propriety of " abortive " treatment. Instead, however, of increasing in intensity, and progressing to decided ardor urinæ, chordee, vesical irritation, etc., they remain *in statu quo* for some days, and then, if not aggravated by improper treatment, subside entirely, the whole duration of the case not exceeding a week or ten days. There are no sequelæ and no complications associated with this condition, which is simply one of mucous irritation and consequent hyper-secretion. It is these cases which give their best opportunities to those charlatans who report cures of gonor-rhœa in incredibly short periods, and who can always muster enough of such irritative cases to give a semblance of truth to their assertions.

The three varieties of urethritis which have thus been described, may be contrasted as follows; it being understood that such accurate clinical differ-entiation does not invariably occur, but that in many cases the characteristics of the different classes are intermingled. The tabular form will be useful in enabling us to recognize at a glance the main points of difference.

Acute Inflammatory Urethritis.	Catarrhal Urethritis.	Irritative Urethritis.
Usually a first attack.	Usually a second or subse-quent attack.	No relation to previous urethral disease.
Begins with a little redness, pouting, and tingling, itching, or smarting at the meatus.	The same.	The same, but to a much less degree.
Rapidly develops free dis-charge, ardor urinæ, chordee, and other symp-toms.	Most of these symptoms, with the exception of the discharge, are absent.	All of these symptoms ab-sent; does not progress beyond this point.
Discharge thick, yellow, greenish, or bloody.	Discharge milky or watery.	Almost no discharge.
Usual complications : Prostatitis. Cystitis. Bubo, etc.	Most common complica-tions : Rheumatism. Ophthalmia.	No complications.
Treatment at first actively sedative and antiphlogis-tic.	Treatment may soon be "anti-blennorrhagic:" cu-bebs, copaiba, etc., with injections.	No treatment necessary.

ACUTE INFLAMMATORY URETHRITIS.	CATARRHAL URETHRITIS.	IRRITATIVE URETHRITIS.
Often subsides permanently with much rapidity.	Apt to be followed by a drop of gleety discharge in the mornings.	Lasts only a few days.
Usual sequel: chronic gonorrhœa, depending on a patch of granular urethritis.	Usual sequel: gleet, depending on a submucous deposit of fibrous tissue.	No sequelæ.

CHRONIC URETHRAL DISCHARGES.

We have thus far been occupied with the *acute* affections of the urethra; but as a direct continuation or prolongation of these, or as more or less remote sequelæ, a number of *chronic* urethral discharges are met with. These may for convenience be divided into three classes: those due to a *urethral catarrh*, a condition often left after the subsidence of an acute urethritis; those dependent upon a *chronic gonorrhœa*, the inflammation having localized itself in some portion of the urethra, producing a granular or even superficially ulcerated surface; and those commonly known as *gleety*, which in almost every instance will be found associated with urethral coarctations, often of the sort known as "strictures of large calibre."

Nearly all chronic discharges arising from the urethra proper will be found to fall under one or the other of these heads, and as it is a matter of much therapeutic importance to be able to distinguish them, their chief diagnostic points may be briefly considered. Of course, it is understood that prostatic, vesical, and other discharges which may at times appear at the meatus, are not here referred to.

URETHRAL CATARRH.—After many cases of gonorrhœa, for some time after the disappearance of the last drops of muco-purulent discharge, there will still be found a condition of excessive secretion, or of increased "urethral moisture," which will often be a source of unnecessary anxiety to the patient and the surgeon. The symptoms associated with this mucous catarrh vary from a mere feeling of wetness about the meatus, to the possible production, by "stripping" the urethra, of a drop or two of clear, albuminoid liquid, slightly tenacious, and resembling that resulting from a prostatorrhœa, with which, indeed, it is often associated. There is no gluing together of the meatus, and no pain or other subjective symptom, except the one alluded to—a sensation of dampness at the very extremity of the penis. This is often so marked as to lead the patient to frequent useless examinations of the organ, or to induce the belief that a free discharge exists, but is absorbed by the dressings or by the underclothing. Treatment of any sort, as a rule, serves only to aggravate or at least to perpetuate this condition, which, in nineteen cases out of twenty, will subside spontaneously in a few days or weeks. If, however, on the supposition that the urethritis is still active, or that he is dealing with a gleet, the surgeon continue treatment, changing from injection to injection, and employing the different anti-blennorrhagics, this state of affairs may be indefinitely prolonged. For this reason, if for no other, the statements of patients as to urethral troubles should always be revised by a careful inspection at each visit on the part of the surgeon himself.

CHRONIC GONORRHŒA.—In other cases, after all marked symptoms have vanished, there will yet remain a milky—or rather, creamy—drop, which can be pressed out of the meatus whenever a few hours have elapsed after urination.

This may come from any portion of the urethra, but will usually be found to proceed from the fossa navicularis, or from the anterior membranous portion. By "stripping" the urethra an inch or so at a time, gradually working backward, or by proper use of a bulbous bougie, as will be described under the head of treatment, a very definite idea of the exact site of the trouble may be obtained. The meatus will often be found a little reddened or swollen, there will be an undue warmth or even a slight scalding on urination, erections will be accompanied with a dull ache, and all these symptoms will be much increased by venereal, alcoholic, or other excesses, especially by prolonged and ungratified sexual excitement and by the free use of spirituous liquors of inferior quality. There is no interval between this condition and the last stage, or rather the previous stage, of an acute urethritis.

GLEET.—In some cases, and especially in those in which the gonorrhœa has been of long continuance, or has been frequently repeated, there will occur another group of symptoms, chief among which is a " gleety" or muco-purulent discharge. In the mornings, the lips of the meatus will be found glued more or less tightly together, and on separating them, a drop of opalescent, whitish fluid will become apparent, or may be squeezed out. There will probably be no pain at any time, unless micturition be attempted in the morning before the meatus has been opened by pulling apart its adherent margins; in that case, the same sort of momentary, lancinating pain may be felt, as is excited by only very moderately compressing the urethra at any point during urination.

The discharge may be more profuse, but cannot usually be found during the day in sufficient quantity to be made apparent at the meatus, owing to the frequent washing out of the urethra by the stream of urine. There will often be found associated with this discharge, a few other symptoms, notably a dribbling of urine at the end of micturition, an increased frequency of the latter act, and a few vague lumbar or hypogastric pains or aches.

This group of symptoms is one of great importance to both practitioner and patient—to the former because, unless they are observed and their cause ascertained, treatment will often be so unsuccessful as to reflect discredit or result in the loss of the patient; to the latter because they indicate the preliminary or formative stage of a condition which, at a later period, becomes of grave pathological importance, and also because, if the condition be at any time curable, it is just when it begins and may be recognized by these phenomena, a rational explanation of which involves the consideration of the so-called " strictures of large calibre." As the very existence of this form of stricture, or at least the possibility of its being a factor in the production of disease, is not infrequently denied, and as any experience, however moderate, with gonorrhœal cases will involve the management of those I am now describing, it will not be out of place here to run over the main points at issue.

STRICTURES OF LARGE CALIBRE.

To account, then, for the symptoms we have detailed, and for the existence of their essential cause, there are certain general physical and physiological laws which should be taken into consideration. Persistent irritation, such as results from frequent or protracted gonorrhœas, causes at any given point in the body an increase in the fibrous tissue of that region, and the deposit or development of new tissue of a similar character. This is especially true of mucous and submucous surfaces, and still more particularly of the urethra, which, by the anatomical peculiarities already mentioned, offers peculiar facilities for the production and organization of inflammatory products.

Such a deposit occurring in the submucous structures around the urethra, interferes to a greater or less extent with the lumen of that canal, and thus constitutes a stricture. Once deposited, here as elsewhere throughout the body, this new tissue tends to contract more or less steadily and continuously. This is in consonance with a well-known pathological law, and the contraction is no more noticeable here than when it occurs in the intertubular spaces in interstitial nephritis, strangulates and destroys the parenchyma of the liver in cirrhosis, produces induration and bronchiectasis in chronic pneumonia, limits the movements of inflamed joints, distorts or deforms after burns and scalds, or in any of the many possible directions exerts its power in the production of disease. We have, then, it must be admitted, in urethritis, a sufficient cause for the production of a condition which tends gradually to diminish the size of the urethra and to interfere with its dilatability.

In studying the effect of this condition in producing the symptoms that have been detailed, certain other physiological laws must be taken into account. For example: Habit is a powerful agent in facilitating and controlling the functions of animal life. Illustrations of this fact in other systems than the genito-urinary are frequent and familiar. The evacuation of the bowels at certain hours of the day, and the difficulties resulting from inattention to their requirements; the easy and unnoticed digestion of food taken at proper intervals, and the anorexia and dyspepsia following irregularity in this respect; the imperceptible and uniform action of the heart under ordinary circumstances, its tumultuous and uneven palpitation when its work is suddenly increased; the many apparently trivial agencies which are notably sufficient to interfere with the mental processes when accustomed routine is broken into; all these are a few of unlimited examples that might be adduced to show the force of habit in influencing the mode of performance of such functions.

To take up the case in question, it is safe to say that, in a healthy adult, a certain equilibrium has been established and maintained between the usual efforts and powers of the bladder as an expulsive organ, and a certain average amount of resistance which must be overcome before it can empty itself. At the age of twenty-one years, this adjustment of force depends upon a large number of previous distinct acts of micturition—about thirty thousand if an average of four daily be taken. This balance between the force of expulsion and its work cannot with impunity be disturbed, and even a slight interference with the calibre of the urethra tends to produce such disturbance.

Apart from the proclivity to muscular spasm in the neighborhood of and behind every stricture, this interference with the action of the bladder arises from the encroachment of the new deposit upon the urethral calibre. It is a law of hydrostatics that, if a current of liquid be passed along a tube, a certain degree of friction proportionate to the amount and velocity of the current and the size of the tube takes place between the walls of the latter and the liquid; if the tube be narrowed at any one place, the friction is increased at that point, and, to avoid a diminution in velocity, the propulsive force behind the liquid must also be correspondingly increased. The pain excited by the very simple experiment of moderately compressing the urethra during micturition, will serve to illustrate the bearing of this fact, as does also the exceedingly slight amount of prostatic enlargement which often suffices to bring on vesical troubles.

Still another point must be mentioned before we recur to the group of symptoms the occurrence of which, after so many cases of gonorrhœa, we are endeavoring rationally to explain. The act of micturition is one requiring for its perfectly normal performance, first the relaxation of certain muscles to secure patency of the urinary channel, and next the thorough and complete

contraction of those muscles to produce entire evacuation of the contents of the passage, "which would otherwise leave it *guttatim.*" The latter portion of this act is accomplished by the contraction of the circular muscular fibres which surround the urethra, and which, during the intervals of urination, in a healthy condition, serve to bring and retain its walls in close apposition. The submucous deposit which increases the friction of the stream of urine at any point, also interferes with the accurate closure of the canal by those muscles whose action is impeded, and whose structure itself is in part often invaded, and as a consequence we have imperfect emptying of the urethra at the end of urination. Finally if, in addition, we recall the intimate nervous connection of the urethra with all the viscera of the abdomen and pelvis, and with the walls of those cavities, and the mutual relation which exists between them, tapeworm having been known to cause all the symptoms of stricture, and stricture of very moderate degree having, as in a case I have recently seen with Dr. Wm. Pepper, produced intestinal irritation with dysenteric symptoms, we are in a position to sum up the relation of the pathological and subjective phenomena as follows :—

The increased friction and resistance resulting from even a slight fibrous peri-urethral deposit, disturb the normal relations of the bladder, and, by rendering it irritable, bring on one of the common symptoms of stricture, frequent micturition.[1] The imperfect closure of the tube, the muscular action of which at the point of deposit is materially interfered with, causes the equally imperfect expulsion of the last drops of urine, and produces another characteristic symptom, dribbling at the end of micturition. The retention and decomposition of these last drops, together with the abnormal friction between the stream of urine and the urethral walls, give rise to a subacute inflammation of the mucous membrane, accompanied with a catarrhal or muco-purulent discharge, constituting the condition of *gleet ;* by reflex irritation transmitted from the area of inflammation, pains in remote organs and situations are developed, notably in the lumbar and hypogastric regions.[2]

This relation of causes and effects has been in the main accepted as correct by the profession for many years. Probably no one denies that in certain strictures in which the urethral calibre is markedly diminished, the connec-

[1] That the same condition of irritable bladder may be produced in the female from a similar cause, is shown in the following case reported by Dr. Matthews Duncan (Medical Times and Gazette, Nov. 16, 1878). "A woman came to us suffering from irritable bladder. She had to make her water frequently, sometimes every few minutes. It was not a case of hours, but of minutes, and she could not get good sleep. On examining this woman we found that there was no orifice of the urethra in the natural situation. She had no history of syphilis, of operation, or of injury ; yet there was no orifice in the situation of the urethra. A little to the right side of the natural position of this orifice was a very slight redness. A little surgical probe pressed against this redness entered the bladder. The orifice of the urethra, then, was strictured. On examining the woman's bladder, we found it not expanded. It was a large bladder, but not larger than you frequently see in healthy women ; but we found the urethra expanded. The bladder-cavity did not begin at the internal orifice of the urethra, but its expansion began at the external orifice. There was no urethral canal. The bladder was not inflamed in any degree ; it was soft, not tender, and large, though not unnaturally large. Now, here is a very plain case. A little operation was performed with a bistoury, enlarging the external orifice of the urethra, so that a number 15, 16, and then 18, were passed into the bladder. Within two days the canal of the urethra had re-formed itself ; and from the moment of the operation the woman was cured. She slept that night, she had no irritability of the bladder at all, and made no complaint. She remains cured."

Dr. Mastin, of Mobile, who has made the interesting observation that cases of constricted meatus are excessively common among the Jews, a result as he believes of early circumcision, has found also that the evils associated with this condition are chronic urethral discharges, irritable urethra, spasmodic stricture, frequent micturition, etc. The average size of the meatus in his cases was something below twelve millimetres.

[2] Van Buren and Keyes record (op. cit., p. 76) a curious case in which a stricture, calibre 13, 3½ inches from the meatus, gave rise to distinct soreness of the mammæ. This was unaccompanied by structural change, and disappeared when the stricture was dilated.

tion between the pathological changes and the observed indications is about as has been stated. The differences of opinion which now exist are chiefly as to the *amount* of urethral contraction which is sufficient to produce noticeable effects, and here the argument must rest upon clinical observation supported by the results of autopsies.

I have now under occasional treatment a curious case showing the effect on the genito-urinary tract and its functions, of a seemingly insignificant encroachment upon the urethra. A gentleman thirty-five years of age, and of unusual physical vigor, has had at intervals of some months several recurrent urethral polypi, sessile, not rising above the surface of the urethra more than a line at the most, perfectly soft, almost gelatiniform, just within the fossa navicularis, and themselves entirely insensitive. These I have now on four occasions during the last three years snipped off, touching the bleeding point afterwards with a drop of nitric acid, after which there has been a period of freedom from annoyance, followed by a return of the polypi, which have been pronounced by Dr. Formad to be typical soft papillomata. The peculiar feature of the case is that, immediately upon their re-growth, my patient experiences certain well-marked symptoms, by which he is always able without inspection to recognize their presence. He has a slight tingling on urination, sometimes a little burning, vesical irritability, and, most marked of all, unnatural sexual excitability—erection and emission on the slightest provocation, premature ejaculation on attempts at intercourse, etc.—all these phenomena disappearing in each instance within a week after the removal of the minute growth. I was at first skeptical as to the association of the conditions, and was inclined to think it imaginary, but the repeated occurrence of the symptoms and their unvarying relief by the operation have convinced me of the contrary.

I have seen and reported[1] a case in which, as shown at the autopsy, a stricture of the calibre of 24 mm. had produced congestion and ulceration of the urethra, dilatation and hypertrophy of the bladder, and dilatation of the ureters; this stricture had been recognized during life. Death resulted from an intercurrent disease.

Recently, after consultation with Dr. Agnew, and with his approval, I performed internal urethrotomy for the relief of annoying symptoms due to a stricture which would readily allow the passage of a No. 32 steel sound, but which re-contracted with rapidity, after dilatation. The operation was followed by immediate, though only temporary, relief.

I have at present under treatment a gentleman who, for three years past, has been continuously affected with albuminuria, which has caused him great anxiety, and has in some respects modified his entire life. He had been under the care of several practitioners in Philadelphia and New York, all of whom seem to have attributed his condition to congestion of the kidneys. His urethra had never been examined. A No. 26 bulbous bougie revealed the existence of two very slight strictures, through which the instrument passed readily, one at $3\frac{1}{2}$ inches, the other at 5 inches from the meatus.

At the time of his first visit to me (April 24, 1882), this patient's urine contained from one-twelfth to one-tenth its bulk of albumen, a small quantity of pus, and a number of casts, either mucous or granular. At that time the diagnosis of both myself and Dr. Formad, who has examined for me a number of specimens of urine in this case, was that the condition was probably one of interstitial nephritis. I proceeded to dilate this patient's urethra gently, and in two weeks all trace of albumen had disappeared, as had also the pus cells and casts, and they have not since recurred, as shown by examinations of the urine repeated at intervals of a few days. The patient himself, who has been in the habit of using the tests by boiling and by nitric acid, says that it is the first time for three years that the albumen has been absent. No other treatment has been employed. These cases bear directly upon the question of the significance of slight urethral coarctations, and are worth recording, although, after a somewhat large experience with this class of ailments, I believe them to be very exceptional.

That every urethral coarctation following on urethritis must at some time have been a stricture of large calibre, is self-evident, but just when such a stricture becomes an active pathological factor, and is able in the manner indicated to give rise to symptoms, is an unsettled point. Indeed, it is not

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[1] Philadelphia Medical Times, May 26, 1877.

probable that it ever can be definitely determined in a mathematical sense. The idea that any particular fixed calibre represents the normal condition of the urethra has long ago been abandoned, the observed variations of that canal being such that no special dimensions can be assigned to it as representing the precise dividing line between health and disease. The old method of regarding the size of the meatus as an indication of the normal calibre of the canal behind it, is also unquestionably fallacious, it having been conclusively shown that no more definite relation exists between them than between any other mucous canal and its corresponding outlet, the mouth and the œsophagus for example, or the anus and the sigmoid flexure. That there is a certain correspondence between the size of the urethra and that of the flaccid penis, is true, the calibre of the one increasing with the circumference of the other, but that this ratio is present in any absolutely unvarying manner, has not yet been demonstrated. At the most, the size of the penis may be said to furnish a general indication of the urethral dimensions, but one which is approximate merely. On the other hand, it has been shown that there are usually certain normal variations even in the spongy portion, which is now claimed with much show of truth as the most frequent seat of pathological contractions, and that it is impossible with any of the means at our command to distinguish between these natural irregularities and coarctations of equal calibre due to incipient stricture.

The discussion of these opposing views, neither of which is without its errors, would exceed the scope of this article, but I may here repeat a statement which I have already made elsewhere, that in my opinion, although our knowledge is insufficient to determine in every case the exact nature or pathogenetic value of any given slight diminution in urethral calibre, *unattended with symptoms*, yet we have abundant evidence, clinical and post-mortem, to enable us to advance, with little risk of contradiction, the following propositions, applicable to the vast majority of cases :—

I. A patient who, after an attack of gonorrhœa, develops the condition which we have described as gleet, especially if the discharge be accompanied by the other symptoms of the group, has, in all probability, a commencing stricture.

II. If a careful examination with a bulbous bougie reveal any abnormal constriction, it may, with confidence, be considered as due to a fibrous deposit in the submucous tissue, and the symptoms may be referred to it.

III. This condition, though yielding readily to proper treatment, is sometimes, if neglected, productive of serious consequences, which, in very rare instances, may even imperil life, through continuous irritation of that portion of the genito-urinary tract which is posterior to the contraction.

DIAGNOSIS OF CHRONIC URETHRAL DISCHARGES.

Fig. 314.

Bougie-à-boule, or bulbous-pointed bougie.

It is evident from the foregoing, that, to arrive at a definite conclusion as to the character and cause of any particular chronic urethral discharge, it will often become necessary to resort to the use of bulbous-pointed bougies, which, for purposes of diagnosis, are of all urethral instruments the most valuable. They may be made of metal with slender stems, having small expanded ends or handles, upon which the number of the instrument may be marked; this should represent in millimetres the circumference of the shoulder of the bulb. More satisfactory instruments are, in my opinion, the flexible gum bulbous-pointed bougies figured in the annexed cut (Fig.

314).   The shoulder of the bulb should join the shaft at almost a right angle, and not with the large obtuse angle often found in improperly shaped instruments.   The size selected for exploration should be determined approximately in the manner already mentioned, by noting the circumference of the flaccid penis.   The scale which I have adopted for use, and which differs from that published by Dr. Otis in giving a lower grade of numbers, is as follows:—

A penis 3 inches in circumference at the middle of the spongy portion, indicates a urethra which should normally admit an instrument of about 26 to 28 millimetres in size; when it is $3\frac{1}{4}$ inches, the urethra should have a calibre of from 28 to 30 mm.; $3\frac{1}{2}$ inches, 30 to 32 mm.; $3\frac{3}{4}$ inches, 32 to 34 mm.; 4 inches, 34 to 36 mm., beyond which size it is seldom necessary to go.

If the meatus be too small to admit of the introduction of a bulbous bougie of the required size, it should be enlarged.   The penis should then be grasped just behind the corona, and held gently between the thumb and finger of the left hand, the foreskin if redundant having been retracted.   The dorsum of the penis should face the abdominal wall.   The bougie well oiled should then be passed gently into the bladder.   If arrested, the point on the shaft corresponding to the meatus should be marked, the distance from that to the bulb representing the position of the anterior face of the stricture.   If that instrument or a smaller size passes through, it should then after a moment's delay be withdrawn, and if during its outward passage any contraction is found other than that at the triangular ligament, which has been shown[1] to be normal, it is probably due to stricture—though spasm, which often relaxes after a few seconds, or shifts its position in the canal, as measured from the meatus, may give rise to errors in diagnosis.   It cannot always with certainty be recognized.   If the urethral discharge in the case undergoing examination be due to chronic gonorrhœa, the instrument will reveal a sensitive, roughened spot, but will impart no distinct sensation of resistance.   In either case there will usually be some pus brought out on the shoulder of the bulb.   In chronic gonorrhœa, this is apt to be stained with a few drops of blood.

The treatment of these conditions will be considered elsewhere, but as regards diagnosis, we may now bring together the main points of difference between the various chronic urethral discharges.

URETHRAL CATARRH.	CHRONIC GONORRHŒA.	GLEET.
Follows immediately on subsidence of gonorrhœa.	Continuous with attack of gonorrhœa, often a first one	Usually a variable interval after subsidence of gonorrhœa; generally after several attacks.
Discharge watery; thin mucus.	Discharge creamy; pus.	Discharge milky or milk-and-watery; muco-pus.
Not much affected by habits.	Greatly aggravated by excess in drink or by sexual excitement.	Increased by same causes, but not to the same degree.
No subjective symptoms.	Warmth or scalding on urination; very slight tendency to chordee.	Dribbling after urination; frequency of urination; hypogastric and lumbar pains.
Affects no special portion of the urethra.	Lingers chiefly about the navicular fossa and the bulbo-membranous junction.	Source of the discharge always back of the coarctation.

[1] Diagnosis of Urethral Stricture by Bulbous Bougies.   By J. William White, M.D.   Philadelphia, 1877.

Urethral Catarrh.	Chronic Gonorrhœa.	Gleet.
Cause : loss of tone and dilatation of capillaries of part.	Persistence of low grade of inflammation. Circumscribed congestion with small granulations.	Submucous deposit around urethra, interfering more or less with its calibre.
Prognosis : subsides without treatment.	Requires local treatment.	If cause be not removed, almost certainly grows worse.
Expectant treatment.	Treatment by local injections.	Treatment by dilatation and injections.
With bulbous bougie, urethra is found to be normal.	Point of sensitiveness, from which bougie brings pus.	Point of moderate resistance.

Seminal Plethora and Urethral Hyperæsthesia.

Before leaving the subject of the symptoms and complications of gonorrhœa in the male, an occasional source of error on the part of both patient and physician must be alluded to. In some cases, treatment is unnecessarily prolonged, and much annoyance is caused by the acceptance, without investigation, of the testimony of the patient as to the existence of a discharge. He will report that every morning, or perhaps only two or three mornings in the week, he discovers a drop of discharge at the meatus, which injections, bougies, anti-blennorrhagics, and other methods of treatment are powerless to dispel. Before concluding that this is an evidence of chronic gonorrhœa or of gleet, it would be well to inquire into the circumstances of the case. It should be remembered that patients suffering with acute gonorrhœa are compelled to make a sudden change in their sexual relations and habits. Previously, whether married or single, in the custom of indulging more or less regularly in sexual intercourse, they are at once absolutely cut off from this normal vent for seminal and other secretions. Superadded to this is the long-continued hyperæmia of the entire genital apparatus, which tends to render such secretions more than usually abundant. Under these conditions, there is often produced a state of "seminal plethora," attended with certain symptoms which are rather those of health than of disease, but which may give rise to mistakes of diagnosis.

The enforced continence, the accumulation of the seminal fluids, the increased reflex excitability of the part, the handling, dressing, and injecting of the latter rendered necessary by the treatment, all combine to render nocturnal erections and emissions more than usually frequent. Very often the latter attract notice in the customary manner by disturbing the patient, or may even be associated with a distinct lancinating pain in the lumbar spine ; but more commonly there will simply be an unusually firm, persistent erection in the morning on first awaking. This will subside in a few moments, and then, on "stripping" the penis, the drop of "discharge" makes its appearance. This is in many cases merely the result of a natural overflow of seminal and prostatic fluid ; is such as often appears at the end of the penis in healthy males after prolonged, ungratified, sexual excitement ; and does not, of course, furnish any indication for treatment. Careful inquiry, the association of the symptoms with the preceding erection, its absence on the mornings when erections fail to occur, and finally the failure to find with the bulbous bougie either the submucous deposit of gleet or the sensitive granular spot of chronic gonorrhœa, will serve to establish the diagnosis.

Such patients, when they are made to realize the true character of this phenomenon, should at the same time be guarded against the danger of falling,

as they sometimes do, into a condition of true sexual hypochondriasis. They should be told that their symptoms are compatible with a high degree of physical health, and are the natural result of certain agencies which can easily be explained to them. If, in spite of this, or in consequence of a mistake as to the meaning of these appearances, the patient does become hypochondriac, it may be necessary, while assuring him of the harmless nature of his symptoms, to administer some anaphrodisiac, preferably bromide of potassium, in doses sufficient to diminish the tendency to erection, and then gradually to withdraw it as previous habits are resumed.

Urethral Anæsthesia.

The reverse of this condition is sometimes met with ; that is, in place of urethral hyperæsthesia with frequent emissions, there is anæsthesia with an absence of sexual pleasure, and a slowness or infrequency of ejaculation even under conditions of natural gratification. This may be associated with nocturnal emissions. I have now under my care a patient, who has been seen by Dr. S. Weir Mitchell, and who, after several attacks of gonorrhœa, developed this condition. He is in no sense impotent, having firm, complete erections, and the genital organs are, to all appearances, normal. He is troubled with nocturnal emissions, two or three weekly, which are unattended with pleasure, or, indeed, with sensation of any kind. On attempting connection, he finds that it is only by vigorous and very persistent efforts that he is able to cause ejaculation, which, although normal as regards the quantity and character of the sperm, is barely perceptible to him, and is not followed by subsidence of the erection except after a long interval. He has no trace of stricture or other urethral trouble.

It has been suggested that this condition is due to an inflammatory change in the nerves supplying the prostatic urethra, as a result of which they have become insensitive, and that the nocturnal emissions are simply an overflow of accumulated genital fluids.[1]

Neuralgia from Urethral Irritation.

In still another class of cases, great sensitiveness along the course of the urethra persists, and may be associated with reflex neuralgic pains. In this condition of hyperæsthesia the urethra is sensitive to the touch, the use of instruments causes great suffering, and erections and emissions are painful. The neuralgias affect chiefly the sciatic and crural nerves, and are even more rare than the previous condition. Hemiplegia, ataxia, paraplegia, and other neuroses have been enumerated among the sequelæ of urethritis, but their connection seems to me more than doubtful. I have never seen any instance of such severe trouble, and the reported cases do not clearly show that the urethral affection exercised any definite causative influence.

In all cases of obstinate urethral neuralgia, spasm, or even discharge, in which no adequate cause can be discovered in the urethra or bladder, it is proper carefully to examine the rectum for worms, for hemorrhoids, and particularly for fissure. I have several times succeeded in this way in discovering and removing the cause of a protracted, painful and annoying condition, which had resisted months of treatment by

[1] Castelnau, quoted by Van Buren and Keyes, mentions a singular condition of prostatic and urethral anæsthesia—the patient having no orgasm, and being unconscious of the passage of semen—left behind by gonorrhœa, and coinciding with an inflammatory engorgement of the urethra. The normal sensation returned after several months.

injections, bougies, etc.   Dr. C. A. Bryce records two cases of this character.[1]   In a case of stricture occurring in a medical student, and associated with the most irritable urethra I have ever had occasion to explore or treat, great temporary relief was afforded by the division of the sphincter ani and consequent cure of a small fissure. Subsequently, however, hyperæsthesia returned, dilatation became impossible, and, after consultation with Dr. Agnew, I performed internal urethrotomy, which resulted in still further improvement.   The patient is yet under treatment.

The great frequency of gonorrhœa rendering it extremely probable that, in any given case of nerve trouble, there has been an antecedent attack of this affection, should make us particularly careful not to employ the *post hoc, ergo propter hoc* method of reasoning.

TREATMENT OF GONORRHŒA IN THE MALE.

The treatment of gonorrhœa in the male requires for success, above all things else, the most careful attention to detail, and without this the best intended therapeutic agencies will invariably prove futile.   I have heard a distinguished specialist remark, that for satisfaction in treatment and certainty in giving relief, he would rather manage any other kind of a case known to surgery ; and Ricord's description of the infernal regions, as a place where the surgeon would be compelled to attend importunate patients with gleety discharges, has become proverbial.   In spite, however, of such unfavorable utterances, I believe a large measure of success can be attained in the treatment of these cases by strict attention to certain points, which I shall make no apology for giving in some detail, in spite of their apparent triviality.   It is chiefly to care in these respects that I attribute the fact, that for the past five years I have found that the time required for the treatment and cure of gonorrhœa has steadily diminished ; and as I see in office, hospital, and dispensary practice several hundreds of cases annually, I feel justified in generalizing from them, and in assuming some authority of statement.

PROPHYLACTIC MEASURES.

It may not be out of place here briefly to allude to the various measures in vogue for the prophylaxis of gonorrhœa among those men who continually expose themselves to the chances of contagion.   The use of a cover, immediate ablution, and urination as soon as possible after the completion of the act, are, it is needless to say, the most reliable means of prevention, and are so well known and so harmless as not to require further mention.   An additional precaution, of which the same assertion cannot be made, is the use of one of the numerous so-called "preventive" injections.   It is a cardinal doctrine of belief with many men that the prompt employment of some particular liquid, the receipt for which has usually been given them by a friend, will effectually prevent the development of venereal disease.   This belief, in so far as it conduces to cleanliness, is of advantage; but whatever good it may do in this manner is far outweighed by the unfounded confidence often occasioned by the possession of such a seeming safeguard, and still oftener by the irritative effects produced by the injection itself.   The favorite therapeutic classes to which these liquids belong are those of the antiseptics and astringents, carbolic acid, Labarraque's solution, alum and tannin, dilute Monsel's solution, and even a glycerite of iodine having to my knowledge been employed in this manner, the first mentioned with great frequency.

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[1] *American Specialist*, February 1, 1881.

In those cases in which the injection is so weak as not to prove an actual irritant, its use, with the usual preliminary urination, is doubtless sometimes beneficial, serving to wash out the urethra. In the majority of instances, however, the extra-professional practitioners who recommend these measures fail to regulate the strength carefully, and, as a consequence, the injection often serves to increase any existing tendency to inflammation, or may itself be the exciting cause of inflammatory action.

Since they are useful only in promoting cleanliness, which can as well be attained without them—and as, on the other hand, they are often positively harmful—it is a good general rule to discountenance their employment. If, for any reason, it seems proper to prescribe a liquid to be used in this manner, great care should be taken to avoid making it of sufficient strength to irritate the urethral mucous membrane, and the patient should be instructed not to use it without dilution if it give rise to any burning or smarting.

Curative Treatment of Gonorrhœa.

In determining the proper treatment for existing gonorrhœa, it is necessary, in the first place, clearly to understand the character and stage of the case with which we are dealing. The classification which has been given will be found a good one for practical purposes, and nearly all cases can be assigned to one or other of the three classes: acute, subacute, and abortive.

To take them up seriatim, we may suppose that a patient belonging to the first or *acute, inflammatory* class presents himself for treatment, with the symptoms characteristic of the early stage: a red, swollen meatus, a little pain on urination, and a muco-purulent discharge. The propriety of employing in such a case the so-called "abortive" treatment at once suggests itself, but, in my opinion, should not at the present day be seriously considered, and for two reasons. In the first place, its theoretical claims depend upon the existence of a specific gonorrhœal virus, to destroy which by means of irritating injections, and thus to substitute a "simple" for a "specific" inflammation, is the aim of the treatment. Enough has been said at the beginning of this article upon the question of specificity; if the views there advanced are the correct ones, the abortive treatment is, from this point of view, unphilosophical and indefensible.[1] In the second place, even if that point were abandoned, there is a strong practical objection to the adoption of this method, in the impossibility which exists of accurately distinguishing at the outset between the different varieties of urethritis—one of which, beyond question, would be greatly aggravated by this treatment. As the most ardent advocates of the abortive treatment only recommend it at the very earliest appearance of symptoms, it is evident that in many cases a slight local irritation, limited to the very extremity of the urethra, and likely to subside spontaneously in a few days, would be converted into a general urethritis, which experience has proved is just as apt to be obstinate, protracted, and attended with serious complications, as an inflammation derived from pus contagion.

This treatment, then, which consists in the injection once or twice of a strong solution of nitrate of silver, or in the very frequent injection of weaker

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[1] Lebert, who is a firm believer in the specificity of gonorrhœa, is compelled to write as follows about the abortive treatment (Ziemssen's Cyclopædia, vol. viii. p. 769): "Theoretically this method is quite satisfactory, since caustic fluids, such as nitrate of silver, often quickly produce a change for the better in acute and recent inflammations of mucous membranes. But this plan is not unfrequently followed by deep-seated, phlegmonous inflammation of the urethra, severe pain, and sanguineo-purulent discharge—in short, by all the signs of intense urethritis. If, therefore, we can by this means deprive gonorrhœa of its specific character, yet we substitute generally a more troublesome and dangerous malady than that which we had to treat."

solutions of the same salt, or of some astringent such as tannin,[1] need not here be further described. Those cases in which it seems to have done good, and to have cut short the disease, are in all probability those belonging to the third or "irritative" variety, and in which, fortunately for the patient, the injections having failed to set up a very intense inflammation, the trouble had subsided as usual, though even then less promptly than it would have done without treatment.[2]

Having decided simply to treat symptoms as they arise, our first care should be to remove as far as possible all additional sources of irritation, chief among which are (1) the influence of motion, friction, and gravitation in increasing the amount of blood in the part; (2) the similar effect produced by sexual stimulus; and (3) the character of the urine which must necessarily come in contact with the irritated surface; this including, of course, the subject of diet.[3]

(1) To overcome the first, rest in the recumbent position is obviously the most important means at our command, and its power in limiting and subduing the intensity of an acute urethritis can hardly be over-estimated. To this power is due the comparative ease with which gonorrhœa can be cured in hospital practice, and I have several times seen threatening cases cut short by the development of some intercurrent disease which obliged the patient to take to his bed. Unfortunately, it is but seldom that this method of treatment can be adopted; business occupations, the pursuit of pleasure, and, above all, the desire to avoid detection, induce the patient to continue as nearly as possible his usual habits, and he rarely feels ill enough at this stage to welcome for its own sake confinement to bed or to a lounge. Nevertheless the general principle should be inculcated and insisted upon. The patient should be told to avoid, in every possible manner, physical exertion, to ride instead of walking, to sit instead of standing, and at such times as may be convenient to lie on his back with his hips elevated. As an inducement to stay at home and maintain this latter position, he may confidently be told that it will greatly reduce the severity and duration of the case.

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[1] Niemeyer, Text-Book of Practical Medicine, vol. ii. p. 93.

[2] A harmless—but, in my experience, valueless—form of abortive treatment is that recommended by Dr. Kuechenmeister, of Dresden, who claims to have found liquor calcis, when properly diluted, extremely serviceable in the first stage of acute gonorrhœa. He uses it in the proportion of one part to four of water, and employs injections, beginning about the fourth day after an impure coitus, and repeats them every hour and a half during the entire day. He has found that the acute inflammatory symptoms usually subside after about twenty-four hours, but that the copious, painless discharge from the urethra is not lessened, and that the treatment, although aborting the first stage, must be replaced during the second stage by the ordinary astringent therapy. Dr. K. prefers, for the latter purpose, a solution of pure alum (10) in water (150), to be injected two or three times daily. (New York Medical Record, August 18, 1880; from Deutsche medicinische Wochenschrift.)

[3] Dr. Louis Bauer, in an article in the St. Louis Clinical Record, after criticizing very severely the treatment recommended in Bumstead's work, and objecting more mildly to that employed by Van Buren and Keyes, thus sums up his views upon the subject: (1) "Gonorrhœa is indisputably a local disease. (2) The cause of gonorrhœa is local also, and of ephemeral duration. (3) Gonorrhœa is inflammatory in character, and if not disturbed by stimulating treatment, limited to the anterior portion of the urethra. (4) Primarily gonorrhœa affects the mucous membrane only. (5) Whatever may be the primary disintegration of the urethral lining by gonorrhœa, the structures involved are endowed with the power of spontaneous repair, that is to say, the reproduction of epithelium. (6) The reason why the erythematous inflammation of the urethral canal deserves special consideration and treatment is its special function to serve as an aqueduct for a saline fluid (urine)." Dr. Bauer advocates what he calls the "rational" treatment of gonorrhœa, the main points of which are: First. To protect the mucous membrane against contact with urine. Second. To dilute the urine by frequent bland beverages. Third. To reduce the inflammation and the hyperæsthesia of the nerve papillæ. This is undoubtedly very excellent treatment as carried out in the injection of an infusion of flaxseed and watery extract of opium, and in the use of demulcent watery drinks, alkalies, and saline laxatives. It is practically that which I have followed for many years, but without being able to obtain such excellent results as Dr. Mullen, of Indiana, who reports, that in nineteen out of thirty cases treated in this manner there was complete recovery in from five to twelve days.

(2) The patient should carefully and consistently avoid the companionship of women of any class, as under the circumstances there is apt to be an exaltation of sexual impulse which renders even the mere proximity of females more or less provocative of erections, or at least of a very harmful hyperæmia of the parts. He should also, of course, endeavor to avoid lascivious thoughts, which, often engendered by the genital irritation already existing, react unfavorably upon it. Believing that functional rest is no less desirable in this ailment than in all other cases of acute inflammation, I do not hesitate to dwell upon the importance of this advice, or to urge upon the patient its strict observance.

(3) In order to render the urine as bland and innocuous as possible, rigid attention to certain dietary rules is indispensable. A skimmed-milk diet is beyond all question the one best adapted to this stage of the disease, and there is no patient who cannot, with a little self-denial, adhere to it for several days, or until all the more marked symptoms have subsided, and that without any very great inconvenience. A few farinaceous articles, or a little stale bread and butter, may be added if the feeling of hunger be obtrusive, but the more nearly the diet is made to consist of skimmed milk, the more likely is it that the patient will escape the severe ardor urinæ and troublesome chordee of the first week or two. Here again, however, the natural anxiety to conceal the disease operates unfavorably. Very few men are so situated that they can make such sudden changes of diet without exciting unpleasant attention and criticism, and in most cases we are compelled to be content with a modification of their ordinary regimen.

Instruct the patient then to reduce his animal food to the minimum, to avoid all greasy, fried, or highly seasoned articles, to abstain from the use of pepper, of vinegar, of salt, of coffee, and of tea. Salad dressings, asparagus, in or out of season, acid fruits, tomatoes, strawberries, etc., pastry of all kinds, and indeed any article of food difficult of digestion, should be strictly prohibited, as should all malt, vinous, and spirituous liquors.

Bumstead interdicts the use of tobacco during the different stages of gonorrhœa, or permits it only in extreme moderation. The reasons he gives for this, however, are very unsatisfactory, as he refers[1] to cases of *spermatorrhœa* in which the symptoms were aggravated by smoking and chewing. The relaxing and sedative, and it may be added, anaphrodisiac, effects of tobacco, it seems to me, rather indicate its employment in the inflammatory stage, and I certainly have never seen any reason to think it did harm. Jullien,[2] after quoting Bumstead, and alluding to two cases in which tobacco was said to have been hurtful, published by Dr. Shipley,[3] adds " We hasten to say that these statements are absolutely unechoed by French specialists."

The patient should be expressly warned against the use of beer and champagne, the two most hurtful, as well as most common, beverages among men of this class, and he should also be informed of the fallacy of the current opinion that gin, by virtue of its diuretic properties, is rather beneficial than otherwise.

If for purposes of concealment it is absolutely necessary that he should go through the form of drinking *something* containing alcohol, the least harmful article is probably weak claret and water. Apollinaris, seltzer, or soda waters are permissible drinks, and may be taken in large quantities, serving then the double purpose of diluting the urine and at the same time reducing the appetite, so as to render more easy the observance of moderation in eating.[4]

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[1] Op. cit. p. 57.   [2] Op. cit. p. 50.
[3] Bost. Med. and Surg. Journal, November 22, 1860.
[4] Zeissl forbids not only beer and champagne, but all drinks containing carbonic acid in a nascent state, as he says that this gives rise to dysuria. (Medical Times and Gazette, Feb. 21, 1880.)

Ordinary drinking water may be taken in the same way, to the amount of three or four quarts daily, with great advantage, and, whenever it is impossible to enforce the milk diet, I make a point of insisting upon its use at this stage; and to meet the same indication—the reduction of the salts contained in the urine—it is well to prescribe some alkaline hydragogue diuretic, combining with it an arterial sedative, and an anodyne directed especially to the genital functions.

The importance of rendering the urine alkaline in the treatment of gonorrhœa is evident to any one who has carefully tested its reaction under varying conditions, as has been done in a number of cases by myself and others. Almost invariably an intense degree of ardor urinæ is associated with more or less decided acidity of the urine. Sometimes the alkalies administered do not seem to have the desired effect, and it was some time before I learned that to bring about and relieve alkalinity of the urine, it was necessary to give the alkaline salts *after meals*, and not during fasting. A series of experiments upon this point were made by Dr. C. H. Ralfe, and recorded in an excellent paper in the Lancet.[1] Long previously (in 1850), Dr. Bence Jones had shown that large doses of sesquicarbonate of ammonium actually increased the acidity of the urine. In 1854, Dr. W. F. Beneke made a similar observation as to bicarbonate of sodium, and in 1860, Professor Parkes recorded a like experience with bicarbonate of potassium. Dr. Ralfe, after carefully detailing his experiments, summarizes his results as follows:—

"The effect, therefore, of bicarbonate of potassium, taken after food, on the acidity of the urine, is different from that when it is administered before meals. For when taken on an empty stomach, we have seen that the acidity on the day of administration was only slightly depressed, whilst on the day following the acidity was considerably higher than it was the day before the salt was taken. But when it was administered during the process of digestion, the acidity of the urine entirely disappeared, being on two occasions neutral, and on one alkaline, whilst on the succeeding days there was no marked increase in the acidity of the urine as compared with that of the days preceding the experiment. And the same difference is observable in the hourly variations of the urine, for when the bicarbonate was taken before meals, the effect of the alkali passed off at the end of two hours, and the amount of acid passed in the succeeding three hours was nearly equal to what was passed on the day no medicine was taken; whilst when the salt was taken after meals, the urine remained alkaline up to the end of four hours after the dose was taken, and no recovery of acidity was noticeable."

The explanation of these facts is found in the circumstance that the bicarbonates are really acid salts, and, if decomposed in the urine, result in the formation of neutral carbonates and *acid* phosphate of sodium. In the intervals of digestion, the reaction of the gastric mucous membrane being neutral or alkaline, they pass unchanged into the blood, and produce the above results. On the other hand, when these salts are taken during digestion, the acid contents of the stomach decompose them; carbonic acid is liberated, which escapes by the mouth, whilst the alkaline bases pass into the circulation and render the urine alkaline.

Of course there are many ways in which these ends may be attained, but the following recipes may be given as samples of mixtures which considerable experience enables me to endorse:—

> ℞.—Tinct. aconiti rad. gtt. xvj.
> Potassii bromid. Эviij.
> Potassii acetat. ℥ss.
> Infus. pareiræ brav. f℥viij.   M.
> Sig.—Tablespoonful in water every two hours.

> ℞.—Tinct. veratri viridis, gtt. viij.
> Potassii bromidi,
> Sodii bicarbonat. āā Эviij.
> Liq. potass. citrat. f℥viij.   M.
> Sig.—Tablespoonful in water every two hours.

[1] Lancet, Nov. 9, 1878.

For the same purpose, and at the same stage of the disease, a powder of tartar emetic and bitartrate of potassium has been found of great use, as has also the addition, to either of the above mixtures, of half a fluidrachm of the tincture of belladonna.[1]

Instructions should next be given as to the best method of retaining such dressings as will serve to collect and absorb the discharge. The use of the India-rubber bags sold for this purpose, the tying of strings or tapes around

Fig. 315.

Dressing of absorbent cotton applied to glans penis.

the body of the penis, and the employment of any warm or cumbersome dressing are decidedly hurtful. Either by preventing evaporation, and thus keeping the penis bathed in a warm, moist atmosphere, or, as it were, poulticed, or else by mechanically interfering with the venous current and exciting erections, they often seem decidedly to aggravate the disease. If the foreskin quite covers the glans penis, the very best dressing consists of a little morsel of absorbent cotton placed over the meatus, and retained within the preputial orifice (Fig. 315). If it nearly covers the glans, but does not extend to the meatus, a small aperture should be cut in the centre of a piece of patent lint or old linen, $2\frac{1}{2}$ to 3 inches square; this should be stretched gently with the fingers until just large enough to slip over the head of the penis, and back of the corona (Fig. 316). The ends should then be turned forward, and the foreskin brought in the same direction, when it will serve to hold the lint

Fig. 316.
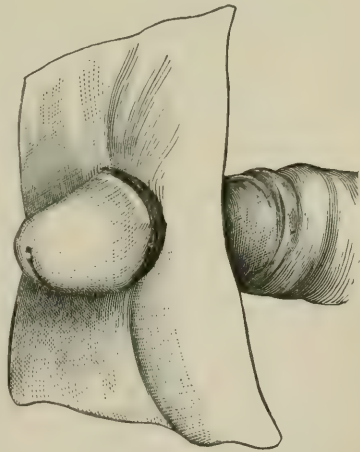
Application of lint-dressing to glans penis.

[1] At this stage of gonorrhœa, the late Dr. John Neill, of Philadelphia, was in the habit of administering the following powder :—

R.—Potass. bitart. ℥iv.
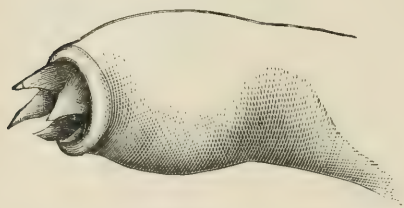　　Potass. nitrat. ℨiij.
　　Antimon. et potass. tart. gr. j.
M. ft. chart. no. xij.
Sig.—One powder in water three times daily.

Mr. Reginald Harrison (Lectures on the Surgical Disorders of the Urinary Organs) believes that alkalies are not indicated in acute cystitis, and says that "the urine is less irritating in its normal acid condition."

or linen in place (Fig. 317). If the glans penis be entirely uncovered, it will be necessary to support the dressing in some other manner. An excellent plan, then, is to take the foot of an old stocking, or a bag of old muslin made large enough to hold the organ comfortably, and pin it to the front of the under-shirt.

Fig. 317.

Lint dressing applied to glans penis: the prepuce brought down to hold the lint in position.

In one or another of these ways, the linen and the surrounding parts of the patient may be protected from the discharge, while, at the same time, no additional element of irritation is added to the case.

The foregoing directions all pertain to the first visit of the patient. Having told him of the importance of rest, indicated his proper diet, prescribed a diuretic mixture, and explained to him the mode of dressing the organ, it only remains to watch the progress of events, for which purpose it is well to ask him to call on you every day for three or four days. If the case belong to the third (irritative or abortive) class, all the symptoms will subside in that time; if to the second (subacute or catarrhal), the discharge will become more profuse, but no marked subjective symptoms will develop; if to the first (acute inflammatory), the phenomena already described will make their appearance, with an intensity proportionate chiefly to the less or greater strictness with which the directions given have been observed. In the first case (irritative gonorrhœa), no further treatment is required; in the second (catarrhal gonorrhœa), we may at once begin with the use of such injections as will be hereafter described as appropriate to the declining stage of inflammatory urethritis; but if we are dealing with a case of the acute, inflammatory variety, we must continue to watch for and treat the symptoms.

TREATMENT OF ARDOR URINÆ.—For the relief of the *ardor urinæ* and tendency to frequent urination, the prescriptions already given are very useful, and should be persevered in, or given in larger doses and more frequently. In addition, the patient may be instructed to immerse the penis in hot water during each urination; the extraordinary relief which this sometimes gives is probably due to the equalization of the blood-supply caused by it, the temporary distension of the superficial vessels relieving, to a certain extent, the congested and swollen mucous membrane, and thereby diminishing the resistance to the passage of the stream of urine, and the friction between it and the sensitive walls of the urethra. The hot-water bath may also serve to overcome spasm of the urethral muscles, which often adds to the sufferings of the patient. When the scalding is very severe and persistent, hot demulcent injections given before urination, after gently "stripping" the urethra, may be ventured upon, but with caution, a good general rule at this stage being to avoid the use of these remedies. An infusion of sassafras pith, or of gum acacia, or of flaxseed, may be used after being strained and warmed, and if it gives relief and is followed by no symptoms of bladder trouble, may be persisted in. In other cases it will be found of advantage to wrap the entire organ in lint, soaked in lead-water and laudanum; or better still in the following lotion:—

> ℞.—Tinct. aconiti rad.,
> Tinct. opii,
> Alcohol. āā f℥j.
> Liq. plumbi subacet. dil. f℥iij.   M.
> Sig.—For external use.

Irrigation, or the use of dry cold by means of the India-rubber coil, is occasionally of advantage in moderating the intensity of inflammation at this period, and consequently in lessening the severity of the scalding.

TREATMENT OF CHORDEE.—In the treatment of *chordee*, attention must be paid to the following points, the first of which is the most important as a prophylactic measure: Before going to bed the bowels should invariably be evacuated, the presence of feces in the rectum contributing largely to the production of erections; to secure a movement at this time, it may be necessary to give a saline laxative during the afternoon or early in the evening, or to use an enema of soapsuds, but in any event it should be attended to. The bedroom must be cool and well ventilated, the mattress hard, and the bed-clothing light.

No late meals should be taken, and any tendency of the thoughts towards sexual matters should be resolutely combated. Soaking the penis in warm water, or the use of a prolonged warm sitz-bath, has been recommended, but does not seem philosophical, and in practice has not proved useful in my cases.

The medicinal treatment of chordee has embraced a great variety of remedies, of which none is at the present time generally recognized as of pre-eminent value. *Opium* in the form of suppositories, used at bedtime, is very efficacious, but not without its disadvantages, the constipation induced by it being prejudicial. It may be necessary to employ it, however, in which case the following formula may be used:—

> ℞.—Pulv. opii, gr. vj.
> Pulv. camphoræ, gr. xviij.
> Ol. theobromæ, q. s.
> M. et ft. suppositoria no. vj.
> Sig.—Use one at bedtime.

Camphor may be given internally in doses of a fluidrachm of the tincture, or in the form of the monobromide, in from three- to five-grain doses. *Lupulin* in fifteen- to twenty-grain doses, and *gelsemium* in the dose of ten minims of the fluid extract, repeated every time the patient wakes with chordee, have in my experience been extremely useful. None of these remedies are, however, so certain in their effects as is *bromide of potassium*, which seems to have fallen into undeserved disrepute. Its employment as an alkali, as an arterial sedative, and as an anaphrodisiac, is especially indicated in the early stages of gonorrhœa, and should never be neglected, even when the symptom of chordee is absent. When that complication exists, the dose of bromide should be increased until decided drowsiness is produced, and it should be given at intervals during the day, with a double dose, combined with ten or fifteen drops of tincture of belladonna, at bedtime, and repeated if the patient awakes during the night with chordee. Under this treatment, pushed vigorously, the patient will rarely have any erections, painful or otherwise.

If, however, in spite of the free use of bromides, the employment of camphor and opium suppositories, and attention to the hygienic rules laid down, the chordee is persistent and very painful, it is well to adopt more active measures for its repression, not only to free the patient from pain, but because each recurrence of chordee aggravates the tendency to inflammation, and,

probably, increases the liability to subsequent stricture. In such cases nothing is so effectual as the free abstraction of blood from the perineum by means of leeches. From a healthy adult, eight or ten ounces should be taken, and for the next day or two he should occupy a strictly recumbent position with the hips elevated. He will usually be found at this time much more amenable to reason as regards the necessity for rest. Among the lower classes, it is well to caution patients against the practice of " breaking" a chordee, by which is meant placing the penis on a hard substance and striking it a blow with the clenched hand. This has the effect of causing the erection to disappear, but also of rupturing the trabeculæ of the erectile tissue and the walls of the congested vessels, and of tearing or breaking up the new deposit which gives rise to the chordee. It is almost always followed by traumatic stricture, and, it is needless to say, is not a justifiable procedure. Upon the occurrence of chordee it is best to urinate, to walk around the room for a few moments, and then to go to bed, lying on the side. The practice of placing the organ on the marble slab of a washstand or on some other cold surface is objectionable, because, when reaction occurs, and is increased by the warmth of the bed, other much more violent erections are apt to follow.

M. Glaudot, following Dr. Scarenzio, recommends as preferable to all other resources in troublesome chordee, the hypodermic injection into the perineum of from one-fourth to one-fifth of a grain of morphia. This should be given just before the patient goes to bed, and after being used on four or five successive nights, may be stopped with a strong probability that the chordee will not return. M. Glaudot thinks that the good effects of the morphia thus used, are due entirely to its local action, as no narcotism, not even sleepiness, was produced in any of his cases.[1] Hill recommends thirty grain doses of chloral. Diday orders lupulin in half drachm doses mixed with an equal quantity of sugar, and in obstinate cases advises that a small pad of cotton soaked in chloroform should be applied to the area of greatest pain for several minutes. I have used ipecacuanha in small, nauseating doses, in cases in which other remedies had failed, but without much success.

More recently Cambrillard has recommended the following injection for chordee :—

> Bromide of potassium, 6 parts.
> Tincture of opium, 2 parts.
> Purified glycerine, 10 parts.
> Distilled water, 150 parts.

To be used four times daily, and retained in the urethra from two to three minutes each time.

Mauriac uses :—

> Syrup of digitalis, 50 grammes.
> Syrup of morphia, 50 grammes.
> Bromide of potassium, 20 grammes.

Tablespoonful each evening, in a cupful of chamomile tea or other convenient vehicle. Suppositories of cacao butter each containing one gramme (15.4 grains) of chloral, may be used instead.[2]

This general plan of treatment should be persisted in while the symptoms are those of increasing inflammatory action, that is during the first eight or ten days. When they cease to grow more and more severe, or especially if they begin to subside, the first evidences of which will usually be diminution in the degree of ardor urinæ, it becomes proper to employ local medication, for which purpose injections are beyond all comparison the best agents.

SOLUBLE BOUGIES.—The use of *soluble bougies*, even in the earliest stages, is so strongly advocated by some writers, that it seems worth while to allude

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[1] Cincinnati Lancet and Clinic, from Archives Médicales Belges.
[2] Saint Louis Clinical Record, March 1882, from Deutsche med. Zeitung.

to them here for the purpose of finally dismissing the subject. Iodoform, tannin, acetate of lead, carbolic acid, oil of eucalyptus, and many other drugs mixed with cacao butter, in proper proportions, have been recommended. I wrote not very long since that in my hands they had been so inferior to injections in their ability to control the discharge, had so often, even when carefully adapted to the acuteness of the symptoms, given rise to severe pain and troublesome chordee, and were besides so comparatively expensive, that I had entirely discarded them. Since then I have been led by reading several articles eulogistic of their merits,[1] to give them another limited trial, but with precisely similar results, and if I ever do return to them in the treatment of urethritis, it will be only on evidence furnished by reliable witnesses after observation of a large number of cases.

Urethral Injections in Early Stage.—To return to the use of injections: —When the surgeon has decided to begin their employment, because of the inflammation having passed its climax,[2] he should order for the patient a blunt-pointed, hard-rubber, urethral syringe large enough to hold three fluidrachms. The American Rubber Comb Co.'s syringe No. 0, and the Goodyear syringe No. 1 c, are those which I prefer. At this stage the disease, although often extending a few inches backward, has reached its greatest intensity at or near the fossa navicularis, a point easily reached by the nozzle of an ordinary syringe, which acts as a mechanical irritant and frequently serves to increase or perpetuate the inflammatory action. Glass syringes are so apt to be poorly made, unequal in calibre at different parts of the cylinder, or with the piston insufficiently wadded, that for these reasons, apart from the danger of breaking them, they should be avoided. The other apparatuses sold for this purpose, the India-rubber bulbs with long glass or rubber nozzles, the soft rubber tubes, etc., are even more objectionable.[3]

Having procured his syringe, the patient should be taught how to use it, and, although it gives a little more trouble, it is always well personally to inspect this procedure at least once. I have seen many cases in which it seemed impossible to obtain control over the disease and to limit the discharge, where the whole difficulty lay in the faulty use of the syringe. In using the injection, the patient should sit upon the edge of a hard chair, the buttocks projecting slightly over it, the feet separated, and the thighs relaxed. In this way all pressure or tension upon the perineal muscles is removed, and the injected fluid finds its way backwards to a sufficient depth. In those cases in which the disease is clearly localized anteriorly, or in which any injection reaching the prostatic urethra or the neck of the bladder,

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[1] Mr. W. Watson Cheyne (British Medical Journal, July 24, 1880) reports extraordinarily favorable results from a so-called "antiseptic treatment" of gonorrhœa, his special plan consisting in the introduction of soluble bougies made of iodoform, eucalyptus, and cacao butter. His results, however, do not appear to have been confirmed by other observers.

[2] Zeissl usually begins the use of injections during the acute stage, while the pains are very severe, and employs permanganate of potassium, two centigrammes in two ounces of distilled water. He cautions against the introduction of air, which he says gives rise to pain. (Med. Times and Gazette, Feb. 14, 1880.)

[3] Mr. Balmanno Squire describes very minutely (Annales de Dermatologie et de Syphiligraphie, Avril 25, 1882) a new form of urethral syringe, which consists of an elliptical body made of rubber, with inflexible sides united by an interposed elastic strip which permits these sides to be accurately approximated. From the body a short rubber tube extends, into the end of which another small glass tube or nozzle is inserted. Mr. Squire claims that the theoretical requirements of a urethral syringe are all contained in this one, viz., possibility of manipulating with one hand; uniform movement without jumps or sudden variation of pressure; durability; portability; capacity just sufficient for the urethra; ability to retain liquid until used, so that a quantity sufficient for one injection may always be carried; and finally cheapness. As far as it is possible to judge from a description and a wood-cut, this syringe seems inferior to several similar devices made and sold in America.

gives rise to vesical irritability, the patient may sit upright, with a handker-chief or towel rolled up and placed just back of the scrotum, thus occluding the urethra at that point. The syringe having been nearly or quite filled, according to the depth to which it is thought necessary to throw the injec-tion, is held between the thumb and middle finger of the right hand, the tip of the index finger resting on the end of the piston. The conical extremity of the syringe is then inserted from a quarter to half an inch within the meatus, which is held open for that purpose by the thumb and fingers of the left hand, and which is then drawn tightly around the syringe, the pressure being made laterally (Fig. 318), so as to narrow the aperture instead of broadening

Fig. 318.
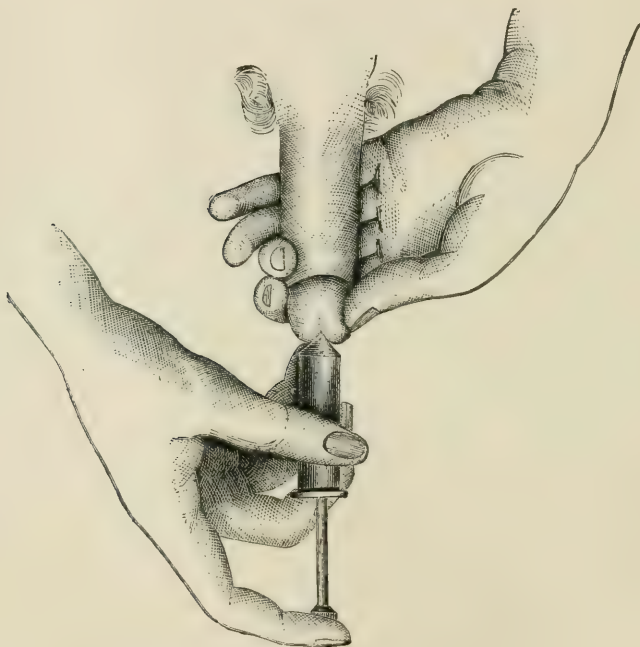
Mode of administering a urethral injection.

it, as when it is compressed in an antero-posterior direction. If this is done properly, while the syringe is depressed so that the piston points about toward the umbilicus and is gently forced home, every drop of the liquid, to the amount of three fluidrachms, should be deposited within the urethra. If the margins of the meatus are not made closely to embrace the syringe, the injec-tion will dribble out over the hand, and down upon the floor. One or two trials will usually overcome this difficulty, but if there is any trouble at first, it is safer to be convinced by actual observation that it has disappeared. The patient should then be told to use the injection in this manner after each urination, and to hold the injected fluid within the urethra for two or three minutes before suffering it to escape.

It may be laid down as a general rule, that any injection, even if it be water, which gives rise to more pain than might be described as a very slight smarting, is likely to do harm rather than good, and should be diluted or withdrawn.

If it be thought proper on account of uncontrollable ardor urinæ, or for any other reason, to begin injections during the early part of the stationary

period, it is well to use only hot water, or, as has been suggested, some hot mucilaginous infusion. When the ardor urinæ has fairly begun to subside, a sedative and slightly astringent injection may be employed, as for example:—

> ℞.—Ext. opii, ℨj.
> Liq. plumbi subacetat. dil. f℥iv. M.

Or

> ℞.—Tinct. aconiti rad. fℨij.
> Tinct. opii, fℨvj.
> Mucilag. sassafras medullæ, f℥iij. M.

During this time, the original internal treatment should be continued, the alkaline diuretic being given in gradually decreasing quantities.

Anti-blennorrhagic Remedies.—When the ardor urinæ and chordee have almost or quite disappeared, a change may be made with advantage in both the general and the local medication. It is at this stage that the employment of the so-called "anti-blennorrhagics" is indicated, the drugs which are usually included under this title being cubebs, copaiba, and sandal-wood oil.

Kava-kava has been used in urethritis, and it is claimed with some success. I have never used it. The formula recommended is,

> Fluid extract of eucalyptus globulus, 60 parts.
> Fluid extract of kava-kava, 20 parts.
> Benzoic acid, 2 parts.
> Powdered borax, 12 parts.
> A teaspoonful three times daily.

According to Dupuy, kava-kava is, (1) a sialagogue, (2) a bitter tonic, (3) a gentle excitant of the nervous system, (4) a powerful diuretic, (5) a blennostatic. The effect of the resin of kava-kava in gonorrhœa, he considers exceedingly favorable; it relieves the pain and diminishes the discharge.[1] Mr. Leighton Kesteven, Colonial Medical Officer at Fiji, writes:[2] "The most marked and valuable property of kava, is its action upon the genito-urinary tracts. Chronic gleet I have found to yield readily to its effects, and in chronic cystitis it possesses an influence superior to any other remedy with which I am acquainted." Cases are reported by Dr. Reed,[3] in which a mixture of kava-kava and glycerine—one to three—in teaspoonful doses, seemed productive of benefit as an "abortive." In the later stages, he thought it less beneficial.

Balsam of gurjun, or wood-oil, a resinous product, has been used as an anti-blennorrhagic. M. Vidal has experimented with it more extensively than any one else, and reports[4] seventeen cases, in which the time of treatment varied from ten to twenty days. He used it in combination with simple syrup in the dose of one drachm, twice a day, taken at the beginning of meals. He writes, that "it is seldom necessary to exceed this dose, which is well tolerated, and of which the only effect on the intestinal tract is the production of one or two stools within two hours after the meal; the maximum dose was eight grammes. At first, a certain amount of nausea is produced, but it passes off very rapidly. A quarter of a glass of wine administered after the potion renders it better tolerated. One of the advantages of the medicine is, that there need be no change in the diet; wine was given during the whole treatment without producing any ill effects. Employed with the same care as copaiba, gurjun presents marked advantages. Its action is more rapid and certain, for it has frequently succeeded where copaiba has failed; it gives rise to no erythema; it gives no unpleasant odor to the breath or urine, which is one of the inconveniences of copaiba; locally, it succeeds well in vaginitis and balanitis; lastly, it costs less than copaiba." More recently, M. Deval corroborates this from observations made by himself in M. Mauriac's Clinique.

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[1] Deutsche medicinische Wochenschrift, No. 1. 1881.
[2] Practitioner, March, 1882.
[3] Therapeutic Gazette, January, 1882.
[4] Journal de Médecine et de Chirurgie, Décembre, 1877.

Of the efficacy of *cubebs*, *copaiba*, and *oil of sandal-wood*, when administered at a proper time, there can now be no reasonable doubt, and any elaborate defence of their employment would be superfluous. Neither can there be much question as to their mode of action, which is manifestly through the urine. It seems essential that they should pass through the kidneys, since injections containing them have not been productive of very good results.[1] It is possible that their action consists rather in modifying the character of the urine, so as to render it unirritating, than in exerting any positively curative power.

However this may be, if they are given at this time, when the declining stage is beginning or is well established, and if they are used with due regard to the digestive powers and the idiosyncrasies of the patient, they will be of great benefit in the vast majority of cases.[2] If they produce anorexia, dyspepsia, or diarrhœa, it will be necessary to vary the mode of administration, and in a few instances no preparation can be found which will be tolerated by the stomach. This is especially true of copaiba, much less frequently so of cubebs and sandal-wood oil. In other exceptional cases they will cause irritation of the urinary passages as well, and must then of course be at once abandoned.

It has been stated that copaiba and cubebs are occasionally the cause of Bright's disease, but there is no authentic case on record of this character, and Zeissl denies its possibility. That they are capable, however, of inducing intense renal congestion, and even hæmaturia, seems beyond doubt. Bumstead and Taylor[3] record a case of this character, and Hill and Cooper[4] mention an instance in which the urine became of a coffee color on the second day of taking a copaiba mixture.

Gubler has apparently shown that the resin is the portion of copaiba eliminated in the urine, the volatile oil escaping by the skin and respiratory organs. Heidenreich has made the same observation as to the oil and the resin of cubebs.

Describing, however, a typical case of gonorrhœa, we may say that the following mixture will be of advantage at this stage, the bromide of potassium being continued in combination with the cubebs :—

[1] Mr. G. De G. Griffith thus alludes (Medical Press and Circular, March 21, 1877) to the local use of the balsam of copaiba. " As a topical remedy, I prefer an alkaline injection, having balsam suspended in it, or, sometimes even the pure balsam itself, and, in obstinate cases, I have found nothing better than the following plan :—

" Make your patient empty the bladder, then rest for a few moments ; again have the bladder relieved of its contents ; next pass down as full-sized a catheter—silver or gum-elastic—as your patient's urethra will admit, having previously charged the instrument with balsam, and smeared its surface with the same. When the eyes of the catheter are in the bladder withdraw your thumb or the leather-covered plug from the opening at the handle end of the instrument. In this way the balsam flows into the bladder, being released from the interior of the catheter which is then withdrawn. The patient again makes the attempt to pass water, the medicament will be expelled, and, in its transit, the urethra will be coated with it more or less completely. Indeed, I have often injected the balsam through the catheter into the bladder, and making the patient empty the latter as speedily as possible, have thus laved the entire urethra with the unctuous remedy. This plan I have found to be specially advantageous when balsam cannot be taken by the mouth, or when the discharge is chronic, or even very chronic, and also when some abrasion has taken place in the urethra, or when a bare, granular surface, or even ulceration, exists."

[2] Bumstead and Taylor write (op. cit. p. 65), that the curative effect of copaiba is much greater in the acute than in the chronic form of urethritis, and that it is rarely, if ever, productive of those complications which were once attributed to it. " In short, it would appear that copaiba can be administered with safety, and to much greater advantage in the acute stage of gonorrhœa, or at an early period of the stage of decline than afterward, and the same is true of cubebs. Still, when a case of this disease presents itself with marked inflammatory symptoms, it is usual to wait for a day or two until these have somewhat subdued—and I do not think that any time is thus lost."

[3] Ibid. p. 69.   [4] Op. cit. p. 512.

℞.—Potass. bromidi, ℥ss.
Oleores. cubebæ, f℥ss.
Ol. sassafras, gtt. xij.
Syr. acaciæ, f℥ij.
Aquæ, ad f℥vj.   M.
Sig.—Dessertspoonful every four hours.

At the same time, the injection may be changed to one containing an insoluble powder, which, by coating the urethra and partially protecting it from the urine, and also by its mechanical influence in constricting the dilated vessels and keeping the walls separated,[1] often serves greatly to reduce the discharge.   The following formulæ are the best among a great many :—

℞.—Bismuth. subnitrat. ℨj.
Glycerinæ, fℨij.
Aquæ ros. ad f℥iv.   M.

℞.—Bismuth. subcarb. ℨj.
Mucilag. acaciæ, f℥ss.
Aquæ ros. f℥iiiss.   M.

℞.—Pulv. zinci oxidi, ℨj.
Acid. tannic. ℈j.
Muc. acaciæ, f℥ss.
Aquæ ros. f℥iijss.   M.

℞.—Zinci sulphat. ℈j.
Plumbi acetat. ℨss.
Tinct. opii,
Tinct. catechu, āā fℨiij.
Aquæ, ad f℥iv.   M.

℞.—Zinci acetat.,
Acidi tannici, āā ℈j.
Aquæ ros. f℥iv.   M.

After the cubeb mixture has been taken for two or three days, if the case is progressing favorably, copaiba may be substituted, or may be added to it, or, better still, capsules containing twenty minims each of oil of cubebs and oil of copaiba may be prescribed in doses of from two to four, three or four times daily.

In certain cases, where these preparations disagree or seem to lose their effect, it will be well to substitute sandal-wood oil, in doses of ten minims four times daily.   This amount may be dropped upon a lump of sugar, which will absorb it, and may then be swallowed and washed down with a little water without difficulty, or it may be given in capsules.   A commercial article is sometimes sold by druggists, which has not by any means the same therapeutic value as the genuine oil, being a decided irritant to both the genito-urinary and digestive tracts.   It may be known by its turbidity or cloudiness, the pure oil being perfectly translucent and of a pale amber color.

ASTRINGENT INJECTIONS.—While using the injections containing insoluble sediments, the patient will often be unable accurately to estimate the character and amount of his discharge.   After a time, therefore, about four or five days, it is well to substitute for them a watery solution of some simple astringent, preferably of sulphate of zinc,[2] beginning with about two grains

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[1] Contact of the two surfaces of the urethra has long been recognized as a source of difficulty in gleet.   Civiale, Milton, and others, endeavored to obviate it by introducing into the urethra and leaving there a long, narrow strip of lint, so as to keep its walls separated.   I have never tried the plan, and should imagine that the danger of the lint slipping into the bladder and its irritating effect as a foreign body would be enough to outweigh any possible advantage.

[2] Jullien (op. cit. p. 72) speaks of the sulphate of zinc as that "précieux agent" which is "le modificateur par excellence de l'urèthre enflammé."

to the ounce, and combining it, if there be any lingering sensitiveness or tendency to scalding, with morphia or dilute hydrocyanic acid, as in the following prescriptions :—

> ℞.—Morphiæ sulphat. gr. j.
> Zinci sulphat. gr. viij.
> Aquæ ros. f℥iv.   M.

> ℞.—Zinci sulphat. gr. viij.
> Acid. hydrocyanic. dil. gtt. xij.
> Aquæ ros. f℥iv.   M.

In this, as in all other cases, if the injection proves to be painful, it should be diluted ; if painless, and if it does not entirely control the discharge, it should be strengthened.

Now, under this treatment, in many instances, the discharge will disappear, and no further symptoms manifest themselves, unless, as often occurs, treatment is prematurely discontinued.   The only safe rule to follow is to instruct the patient *gradually* to stop the use of injections and decrease the dose of medicines, omitting first the mid-day portions, then those of the morning, and last of all those taken just before going to bed ; the whole process should extend over ten days.   He should be cautioned also against frequent or vigorous " stripping" of the urethra for purposes of inspection.

TREATMENT OF PERSISTENT URETHRAL DISCHARGES.—If, in spite of the injections as above given, the discharge continues, recourse may be had to stronger solutions, the sensibility of the urethra being taken as the index. In this way five or six grains of zinc to the ounce will often effect a cure when weaker injections have failed.   Or acetate of zinc, tannin, sulphate of copper, nitrate of silver, sulpho-carbolate of zinc, alum, tincture of catechu, hydrastin, and various other drugs, may be employed occasionally with advantage.

Surgeon-Major Wilson reports in the Lancet, for September, 1881, sixteen cases of gonorrhœa treated by injections of sulphurous acid and water, one part to fifteen.   He says that under this treatment the purulent discharge becomes scanty on the first day, and on the third day is replaced by a thin gleety discharge, which also disappears in a few days.   It is probable that his cases were of the " irritative" kind, and would have recovered as soon with any treatment not absolutely prejudicial.   Dr. F. R. Fry[1] attributes Mr. Wilson's success to the fact that he was dealing with " non-specific" urethritis, which is about equivalent to my own understanding of his results.

A remedy which has acquired considerable reputation as an injection is the hydrastis canadensis, or "golden seal," the fluid extract being the preparation generally employed.   It is used either alone or in combination with some astringent and sedative, as follows :—

> ℞.—Ext. hydrastis fld. f℥vj.
> Zinci sulph. gr. xij.
> Morphiæ sulph. gr. ij.
> Mucilag. acaciæ, f℥j.
> Aquæ, f℥iij.   M.

Radha Nauth Roy, Assistant Surgeon, Aliquah, reports great success attending the use of injections of quinine in both the acute and chronic stages of gonorrhœa.   He employs a solution of two grains in eight minims of dilute sulphuric acid and a fluid-ounce of rose-water, and says that it " acts like a charm," the disease generally being cured within a week.[2]   Experiments with this mode of treatment, made at the Venereal

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[1] St. Louis Courier of Medicine, October, 1881.
[2] Indian Medical Gazette, May 1, 1876.

Dispensary of the Hospital of the University of Pennsylvania, have failed to confirm these statements.

A favorite prescription of the late Dr. Maury was :—

  ℞.—Tinct. matico,
    Tinct. catechu, āā f℥j.
    Ext. opii, gr. xvj.
    Plumbi acet. gr. xij.
    Glycerinæ, f℥iv.
    Aquæ ros. f℥vss. M.

Boracic acid, in the strength of five grains to the ounce of water, is strongly recommended as an injection by Dr. James G. Hyndman, of Cincinnati, and by others, who report unusual success following its employment in a number of cases. I am not able to confirm this opinion of the remedy, although I tried it in a number of cases at the time attention was first drawn to it.

The relative merits of these various remedies are unsettled, and an attempt to formulate them would require detailed description which would extend this article far beyond the prescribed limits. It may be assumed, however, that if, after careful attention to the rules already laid down, and the final trial of some of these supplementary remedies, a urethral discharge persists, it will fall under one or another of the divisions laid down on page 351, and will require corresponding treatment.

Diday, whose forty years of large experience entitle him to respectful attention, describes his treatment of gonorrhœa as follows, dividing the disease into four stages :[1]—

First Stage.—Warmth during micturition ; a drop of semi-transparent discharge at the meatus. Inject one drachm of a solution of nitrate of silver, one part in ninety, and retain for five minutes. In successful cases the discharge wholly disappears.

Second Stage.—Red, shiny meatus ; hourly drop of yellow or greenish discharge ; ardor urinæ ; chordee. The secret of success in treating gonorrhœa lies in patient expectation throughout this stage, with the use of demulcent drinks, restricted diet, and rest.

Third Stage.—Reached on an average in five or six weeks, often not until two and a half or three months have elapsed. Meatus normal; almost no ardor urinæ ; discharge less abundant and whitish. Copaiba, or cubebs and copaiba, and an astringent injection, are the remedies indicated.

Fourth Stage.—Usually the result of attempts at early suppression. Little or no pain ; discharge small ; disease unaffected by copaiba and cubebs ; readily becomes worse under irritants. Here the main dependence should be placed upon injections, among which he prefers that of Ricord :—

  ℞.—Zinci sulph. gr. viij.
    Plumbi acetat. gr. xvj.
    Tinct. opii,
    Tinct. catechu, āā f℥ss.
   Aquæ ros. ad f℥iv. M.
  Sig.—Use three times daily.

TREATMENT OF URETHRAL CATARRH.—If the characteristics of what I have called urethral catarrh are present, a little attention to the general health, a few drops of the syrup of iodide of iron after meals, moderate exercise and fresh air, a free diet, with an occasional glass of claret or burgundy at meals, will usually be sufficient, without local treatment, to terminate the case. Perseverance in the use of astringent injections and in the introduction of bougies will sometimes hasten the cure, but quite as often seems to retard it. These constitute the majority of those chronic urethral cases which are

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[1] Diday et Doyon, Thérapeutique des Maladies Vénériennes, etc., pp. 8–39. Paris, 1876.

often reported by patients as having been cured by homœopathic treatment, the negative character of which leaves free play to that *vis medicatrix naturæ*, which is really all that is required.

TREATMENT OF CHRONIC GONORRHŒA.—In other cases, particularly when the attack is the first one, the discharge persists, creamy or yellowish in appearance, associated with a few mild subjective symptoms, indicative of localized inflammation which proves to be easily warmed up into a state of activity; in other words, we have the condition which it will be convenient to designate as chronic gonorrhœa. To determine this beyond question, a bulbous bougie, three or four sizes smaller than the normal calibre of the urethra, should be gently inserted into the bladder, the surgeon noting as it goes in the exact situation of any point of unusual sensitiveness, and looking even more carefully for this or other similar points during its withdrawal. He must not be misled by the normal sensitiveness of the prostatic urethra, which almost invariably resents the introduction of an instrument for the first time. He should look at the shoulder of the bulb, and observe whether it brings out any discharge, and if so, notice its character. If the symptoms and appearances which have been described as characteristic of chronic gonorrhœa are present, it may be assumed that the sensitive spot corresponds to a small patch of granular urethritis to which it is necessary directly to apply appropriate remedies. For this purpose, the patient should be ordered a prostatic syringe of hard rubber, having a long curved nozzle with a bulbous tip. He should be instructed in what manner and to what depth

Fig. 319.
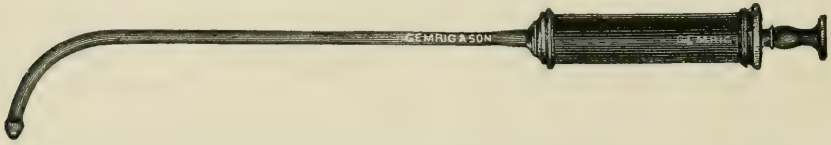
Prostatic syringe.

to insert this instrument, and the surgeon should himself administer the first two injections. For this it is well to use about one fluidrachm of a solution of nitrate of silver, of the strength of half a grain or a grain to the fluidounce of distilled water, or if this does not give rise to pain on the first injection, in still stronger solution. The discharge and pain may be increased for a short time after these injections, which should then be followed by gradually strengthened solutions of sulphate of zinc, tannin, or sulphate of copper, carried to the exact spot in the same manner. If the discharge diminishes, but does not disappear, the same process may be repeated, and this will almost invariably result in permanent cure.

It should never be forgotten that in certain cases, especially in those in which a history of frequent or prolonged attacks of gonorrhœa emphasizes the probability that some narrowing of the urethra exists, we may have the progress of the injection backwards cut off by spasmodic contraction of some of the circular muscular fibres surrounding the urethra, particularly that aggregation of those fibres which is called the *compressor urethræ* muscle, and which encircles the membranous portion of the canal, situated between the two layers of the triangular ligament. This, or a similar contraction, often so firm as absolutely to prevent the entrance of instruments however skilfully handled, will also in some cases, occurring as soon as the first drops of the injection reach the locality, effectually prevent the liquid from passing any

further, and will thus prevent it from coming in contact with the inflamed, or congested, or ulcerated surface which is the source of the discharge. In these cases the cure of the stricture, spasmodic or otherwise, by the use of full-sized sounds, is imperatively indicated, all other treatment being worse than useless.

Irrigation of the urethra with various medicated liquids has been recommended,[1] and is a most useful procedure in those few cases in which the foregoing treatment proves ineffectual. A moderate-sized, short, flexible, rubber catheter—preferably a "Nélaton"—with large bevelled eyelets, should be

Fig. 320.
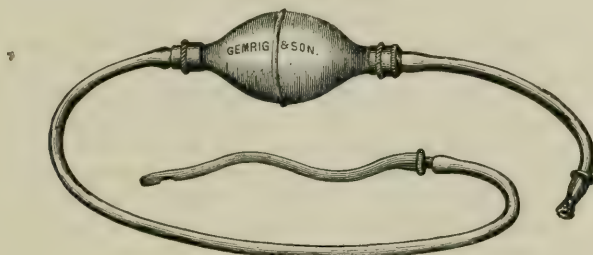
Irrigating apparatus for gleet.

inserted nearly into the bladder, and then connected with a syringe, like the ordinary "Mattson" or "Davidson" syringe. A pint or more of the preferred solution, usually one of the astringents above mentioned, may then be passed through the urethra without withdrawing the catheter, the lotion finding its way between the instrument and the walls of the urethra, and making its exit at the meatus. In one or the other of these ways chronic gonorrhœa is always curable.

Durham[2] advocates irrigation in the treatment of urethritis, and employs a bulbous tube with apertures near the end, which is inserted beyond the inflamed part of the urethra. The injection is then pumped through by means of a Higginson's syringe.[3]

Mr. Whitehead, surgeon to the Manchester Royal Infirmary, recommends[4] that irrigation be employed in gonorrhœa to free the urethra from the inflammatory products, which obstinately and intimately adhere to the surface of the urethra, and protect the mucous membrane from the immediate influence of the remedies we endeavor to bring into action, either through the urine medicated by the administration of balsamic drugs, or by the more direct influence of anti-blennorrhagic injections. He describes and figures vulcanized and soft rubber catheters, having a deep spiral groove extending from tip to stem on their outer aspect. This groove is made with a depth double the capacity of the central tube, so that the facilities for the return of the injected fluids are greater than the requirements. The catheter ends in a large hollow bulb, perforated with two large apertures directed backwards. He regards the irrigation as a *preliminary* to treatment, and follows it by the injection of a medicated solution adapted to each particular case. I have had an instrument of this kind made, and have used it a few times, but am inclined to think that the irregularities of its surface, by increasing the pain of its introduction, are so great a disadvantage as to more than counterbalance any possible benefit.

Irrigation with *hot water* has been employed in gleet with apparent advantage.[5] I

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[1] The Prevention of Stricture, by R. Harrison, F.R.C.S. Lancet, May 15, 1880.
[2] Guy's Hospital Reports, 1870.
[3] See also Jullien, loc. cit., p. 89.
[4] British Medical Journal, April 8, 1882.
[5] Medical and Surgical Reporter, January 14, 1882.

have had no experience with this remedy as used in the gleety stage of gonorrhœa. It is unquestionably efficacious in the early stages.

The "cold-sound" (psychrophor), an instrument originally described by Dr. Winternitz, of Vienna, consists of a double-current catheter without eyes, the two canals communicating with each other near the point of the instrument, which can be introduced to the desired point in the urethra, and then attached by rubber tubing to a vessel containing fluid of the right temperature which is passed through the tube for a somewhat prolonged period. In a few cases of hyperæsthesia with persistent and frequent nocturnal emissions, I have found this instrument of great value. A few cases of chronic gonorrhœa also seemed benefited by it, but in these the effect may have been, as indeed it may in the others, merely a result of dilatation. My experience has not been extensive enough to justify a very positive opinion as to its usefulness. Keyes has found the psychrophor of use in cases of gleety discharge from relaxed urethras, without the presence of stricture. He employs iced water, allowing it to trickle through the catheter for about five minutes at each sitting.

In the chronic inflammations of the urethra, M. Mercier,[1] of Paris, recommends injections of nitrate of silver. If the spongy portion is affected, he uses a solution of one or two grains in an ounce of distilled water, making the injections in the ordinary way at intervals of from two to three days. In chronic prostatic urethritis he begins with these solutions, and gradually increases the strength to three or four grains to the ounce. He directs that the bladder shall always contain urine at the time of injection, so that the salt may be decomposed at once on its entrance into that organ, and calls attention to the fact that fluid deposited in the urethra anterior to the membranous portion will flow out of the meatus; while, on the other hand, fluid injected beyond this point invariably finds its way into the bladder.

Dr. Vajda[2] claims better results from continuous irrigation of the urethra than from any other method he has tried. He uses a perforated soft rubber catheter and a rubber water holder.

M. Pasqua[3] recommends, as an injection, a solution of chloral of a strength of about five grains to the ounce of rose-water. "Two injections daily of a few minutes' duration have seemed to him sufficient. They produce at first a slight smarting and sensation of pricking, which in two or three minutes give place to a pleasant coolness. From the third or fourth day of the treatment, the desire to micturate and the erections become less painful and less frequent, the discharge diminishes, becomes more and more clear, and ceases altogether about the eighth or tenth day."

TREATMENT OF GLEET.—If now we find a patient with a true *gleet*, having had several previous attacks of gonorrhœa, or one which has been very protracted, and with dribbling after urination, etc., we should carefully examine his urethra with a bulbous bougie, when we shall probably find the condition described on p. 352, which is indicative of the presence of a submucous deposit, or a "stricture of large calibre" or commencing stricture. The importance of remembering that, in every normal urethra, the bulb of the instrument will meet with some resistance as it passes under the posterior layer of the triangular ligament, is such, and a failure to recognize this fact has been so frequent a source of error in diagnosis and treatment, that it seems worthy of reiteration. For the proofs upon which the assertion rests, I must respectfully refer to the article already mentioned (p. 357).

Another source of error, already alluded to, is spasm of the muscular fibres occurring at some point along the urethra, and often imparting to the bougie the precise sensation felt in passing a stricture. The possible association of spasms of this character with strictures of large calibre situated anteriorly, should never be forgotten.

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[1] Du Traitement des Inflammations des Organes Génito-urinaires. Paris, 1877.
[2] Schmidt's Jahrbücher, Bd. 188, No. 11.
[3] Bulletin Générale de Thérapeutique.

On account of the importance of avoiding this error, I may be pardoned for quoting in this connection some remarks of the late Dr. T. B. Curtis, of Boston, the author of several valuable papers on genito-urinary diseases. He remarked[1] that " these disturbances [urethral and vesical spasms] are most common perhaps in persons suffering from urethral stricture ; not only in cases of inveterate, narrow, deep-seated strictures, which every practitioner, however inexperienced and uninformed, is ready to recognize as such ; but also, as shown by Verneuil, Guyon, Otis, J. Wm. White, and many others, in cases of tolerably wide anterior stricture of recent development. In such cases the most conspicuous symptom, or perhaps the only other symptom, complained of by the patient besides the urinary stammering and urethrismus, is an obstinate gleet. Not only acquired strictures of comparatively wide calibre, but even, as abundantly shown by Dr. Otis and others, congenital contractions of the meatus, more or less pronounced, and playing the part of strictures, behind which chronic urethritis, or gleet, has established itself, may be the origin and perpetuating cause of the nervous disturbances which are expressed in the form of chronic urethral spasm. Until the publication of Dr. Otis's views and experience in 1876, corroborated by the testimony of Dr. J. W. White in 1877, it had been almost universally agreed that spasm of the urethral sphincter was always temporary, and that the obstruction so caused was in all cases to be distinguished from that due to organic or permanent stricture by its short duration or by its intermittent character." These cases, however, demonstrated that a spasmodic contraction possessing all or nearly all the clinical characters of organic stricture, might be caused and perpetuated by a large stricture of the penile urethra, or even by contraction or stricture of the meatus. When spasm is suspected to exist, therefore, these latter conditions should be carefully searched for and removed, whereupon in every instance the spasm will promptly disappear.

It should not be forgotten that, in certain extremely exceptional instances, a stricture may be so easily distended as to permit of the uninterrupted entrance and withdrawal of a very large sized instrument, and yet so elastic as immediately to contract and become a source of discharge, vesical irritability, etc. In one such case, already mentioned, which Dr. D. Hayes Agnew saw with me, the urethra would admit a No. 32 steel sound with great ease, and yet a No. 18 or 20 bulbous instrument invariably disclosed a distinct abnormal contraction in the membranous urethra. In this case I performed urethrotomy with a bulbous urethrotome, and subsequently dilated with a Thompson's dilator to 36, securing a long interval of apparent health. The stricture, however, has returned and is again becoming troublesome. Such conditions, as I have said, are of great rarity, but their occasional occurrence cannot be denied, and they afford an additional argument in favor of the careful exploration of the urethra with a *bougie-à-boule* in all cases of obstinate gleet.

Strictures of Large Calibre.—Having then determined the existence, situation and calibre, and exact character of an abnormal coarctation, the patient should be instructed to return in five or six days for treatment, being told, as in all cases after the first use of urethral instruments, that probably there will be some scalding when he next urinates, and that a few drops of blood may make their appearance.

At the end of that time, a conical steel sound about two numbers larger than the bulbous bougie originally used, and with the proper urethral curve—the arc of a circle having a radius of one and five-eighths inches—should be warmed, oiled, and very gently inserted into the bladder. It should be withdrawn far enough to relieve the desire to urinate, usually excited by its presence, and should then be allowed to remain *in situ* for from three to five minutes, provided that it does not give rise to continued pain. After five days or a week, according to the amount of subsequent irritation, a sound a size or two larger should be employed, and this should be continued until the normal calibre of the urethra is nearly or quite represented by the size of the instrument. This mode of treatment is safer, surer, and less painful than either urethrotomy

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[1] Boston Medical and Surgical Journal, May 12, 1881.

or divulsion, which I reserve for excessively irritable or contractile strictures. Meanwhile astringent injections should be used, strong enough and often enough to cause the disappearance of the discharge. If employed too weak, or too seldom, they will be almost useless.

During all this time, in the treatment of both chronic gonorrhœa and gleet, the diet should be moderate and simple, and alcoholic beverages, especially beer and champagne, should be strictly avoided. So also should sexual excitement, particularly if prolonged and ungratified. Anti-blennorrhagics are sometimes useful adjuvants. There are many little details, not altogether unimportant, which want of space excludes; but I believe that a careful observance of the foregoing methods of treatment will, in the majority of cases, yield satisfactory results.

Some years ago, in cases of gonorrhœa, the following therapeutic measures were employed in the London Hospitals.[1] I am not aware how far time has modified them, but they are still of interest :—

Mr. Bryant, at Guy's Hospital, gave the tartrate of potassium in 20 or 30 grain doses three or four times daily, and found treatment by injections very unsatisfactory. He had, however, effected rapid cures by the injection every hour of a solution of alum or of tannin, 2 grains to the fluidounce.

Mr. Maunder, at the London Hospital, gave copaiba during the onset and subsidence, and during the height of the disease used acetate of potassium—20 grains every four hours—with or without the eighth of a grain of tartar emetic and morphia. He also employed oft-repeated injections of sulphate of zinc.

Mr. Callender, at St. Bartholomew's, gave laxatives, diluents, warm baths and fomentations, opium or morphia suppositories, and, after the local inflammation had been allayed, ordered injections of sulphate of zinc, two grains to the ounce.

Mr. Wood, at King's College Hospital, prescribed at first low diet, saline aperients, diluents of liquor potassæ or bicarbonate of potassium, in camphor mixture or in an infusion of pareira, the frequent injection of glycerine and water, two fluidounces to eight, followed in the chronic stage by copaiba or powdered cubebs, frequent injections of sulphate of zinc, alum, etc., and at a still later period, by tincture of the chloride of iron and injections of the chloride of zinc.

Mr. Gascoyen, at St. Mary's Hospital, in the very early stage, before much inflammation had set in, used weak astringent injections, frequently repeated ; after the height of the disease was reached, he believed that copaiba was the most reliable remedy. After the violence of the attack had subsided, he again used weak injections, and gave cubebs and quinine. He found the treatment by salines and depletory remedies in the early stage of gonorrhœa not only useless, but positively injurious. He had scarcely ever known the so-called "abortive" treatment to succeed.

Mr. Barwell, at Charing Cross Hospital, avoided copaiba, which was apt to increase or lengthen the disease. In the case of a first attack with high inflammation, he used a purge, hot baths, and alkaline diuretics and aperients, followed by an injection of sulphate of zinc, two grains to the fluidounce. Second or subsequent attacks he treated with injections without any preliminary preparation. He also used tannin, three or four grains to the fluidounce of starch-water or syrup. In chronic gonorrhœa, turpentine, with black or cayenne pepper was useful, but the most certain treatment was the introduction every other day of a bougie smeared thickly with an ointment of from 3 to 10 grains of nitrate of silver to the ounce of lard.

Mr. Heath, at University College Hospital, used injections from the first. In the premonitory stage he believed in the efficacy of a strong lead lotion—Liq. plumbi subacet. f3j, aq. f℥vij—and in the acute stage, warm water and a weak lead lotion, with bicarbonate of potassium internally, followed subsequently by an injection of sulphate of zinc. In gleet, if a distinctly diseased surface was discovered, the application of a strong solution of nitrate of silver gave the best results ; if the disease were more general, astringent injections and the passage of a large-sized steel bougie were the

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[1] Lancet, March 16, 23, 30, and April 13, 1867, pp. 331, 362, 411, 458.

remedies used. He believed that in many chronic cases the so-called gleety discharge was nothing more than the ordinary secretion of the mucous follicles of the urethra.

Mr. Hulke, at Middlesex Hospital, treated gonorrhœa almost exclusively by injections, first of acetate of lead, then of nitrate of silver, using weak injections frequently or strong ones at longer intervals. In old gleet he occasionally used cubebs or copabia, but more frequently tincture of the chloride of iron.

Mr. Watson, at King's College Hospital, used injections of half a fluidrachm of carbolic acid and one drachm of bicarbonate of potassium to a pint of water, every two hours, at the commencement, when the inflammation was not marked; subsequently he gave acetate of ammonium and tincture of hyoscyamus internally, and discontinued the injections, though at a still later period he returned to them.

TREATMENT OF COMPLICATIONS.

We may now proceed to consider, in the order in which they were described, the treatment of the various complications of gonorrhœa:—

BALANITIS usually requires for its treatment only perfect cleanliness and the use of some desiccant sedative powder, the one which I prefer consisting of opium and lycopodium (R. Pulv. opii, ℈j; lycopodii, ℥ij.). Three or four times daily this should be dusted on the inflamed surface, previously washed and gently dried. Strips of dry lint inserted between the glans and foreskin, and changed whenever they become moist from the discharge, will often effect a cure.

Balano-posthitis, when accompanied with œdema of the prepuce, is best reduced by a lotion of lead-water and laudanum kept continuously applied. The dry dressing may be used with advantage after the swelling has subsided. I have seen good in both these cases follow from painting over the inflamed glans and the inner surface of the foreskin with a 30 or 40 grain solution of nitrate of silver.

PHIMOSIS may of course be relieved by circumcision, or by slitting open the foreskin along the dorsum, completing the operation at some later period; but both of these procedures are undesirable if it is possible to avoid them. In nearly every case, lead-water and laudanum externally, with sub-preputial injections of soap and water, followed first by clean water, and then by lead-water

Fig. 321.

Taylor's syringe for sub-preputial injections in cases of phimosis

and laudanum, will reduce the swelling, so that the glans may be uncovered. A convenient instrument for the administration of sub-preputial injections is that devised by Dr. R. W. Taylor, of New York, and shown in Fig. 321. If the phimosis be obstinate, it may sometimes be necessary to confine the patient to his bed for a day or two, enveloping the penis in the same lotion, keeping it in an elevated position, and encircling it with a narrow strip of bandage. If actual ulceration have occurred, healing will be promoted, after the inflammation has been reduced, by the use of an astringent injection beneath the prepuce, the old-fashioned combination of sulphate of zinc with laudanum and water being one of the best.

PARAPHIMOSIS, if seen at first while the preputial swelling is œdematous and not inflammatory in its character, should be immediately reduced.

The ordinary procedure, and one which usually suffices (Fig. 322), consists in oiling the parts, locking the index fingers of the two hands above and behind the corona glandis, the middle fingers below and beneath it, and gradually compressing the glans itself with the thumbs, emptying its congested vessels and finally forcing it backward while the fingers bring forward the swollen foreskin. Or the body of the penis may be encircled with the thumb and index finger of one hand, while with the other, the glans is gradually compressed and pushed into the preputial orifice. (Fig. 323.) It must be remembered that, not only the glans, but also a ring of swollen mucous membrane is to be returned through that orifice. Sometimes by slightly elongating the parts instead of pressing them directly backward, their transverse diameter will be lessened, and their reduction will be facilitated. If the tip of the forefinger can be insinuated beneath the constricting ring, the subsequent treatment becomes easy.

Fig. 322.

Reduction of paraphimosis by ordinary method.

When these means fail, or indeed, in preference to them in many cases, the method of Mr. Eddowes (Fig. 324) has in my hands been most satisfactory. It consists in wrapping the glans

Fig. 323.
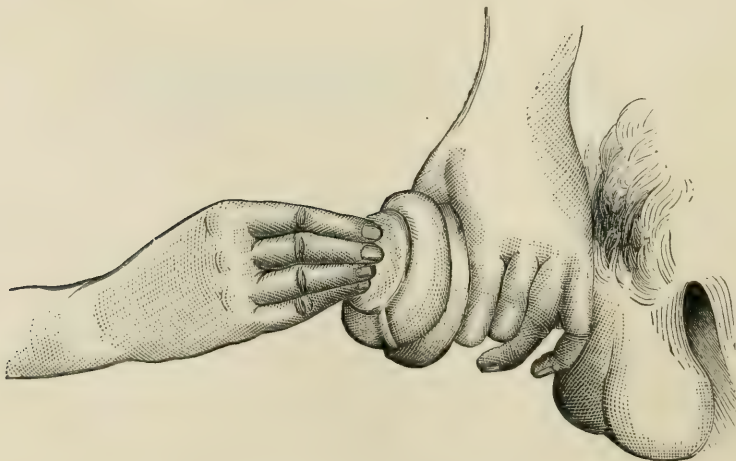
Reduction of paraphimosis by another method.

and prepuce with a slip of wet lint two inches wide, and extending a little in front of the glans, and then winding around the glans from before backward a piece of round elastic ligature.

Fig. 324.

By the time the corona is reached, the glans will be reduced in size, and it will be often possible to slip the end of a grooved director, the bend of a hair-pin, or the edge of the thin flat handle of a small spoon—such as a salt-spoon—beneath the constricting band. Then withdrawing the ligature rapidly, the shrivelled glans may be pushed backward, and the prepuce drawn forward to its natural position. Tape or a narrow bandage may be used instead of the gum cord, but is

Reduction of paraphimosis by Eddowes's method.

not as effective. If the chief obstacle to reduction be the amount of œdema, it is proper to evacuate the serum by several minute punctures with an exploring needle.

When the paraphimosis has been of longer duration, and an effusion of plastic lymph is present, more permanent compression may be required, and in that case the glans and foreskin should be "strapped" with pieces of adhesive plaster one quarter of an inch in width and six inches in length, the extremities beginning and ending on the body of the penis, the strips passing over the glans so as to cover all portions but the meatus; in twenty-four hours reduction usually becomes possible. If not, the dressing should be removed.

If all these means fail, we may divide the constriction on the dorsum of the penis by inserting beneath the prepuce a flattened sharp-pointed bistoury, and then turning its edge and cutting upward; or the stricture may be cut down upon from without inward, always remembering to look for it in the furrow which divides the mucous membrane from the integument, the first one *behind* the furrow of the cervix glandis.

FOLLICULAR ABSCESS often opens spontaneously into the urethra, and requires no surgical interference. When the skin becomes thinned and discolored over such a swelling, it is well to incise it freely. I have never seen any necessity for enucleating the wall of the abscess, or for treating it otherwise than would be proper for a similar condition elsewhere.

PERI-URETHRAL ABSCESS should be evacuated more promptly, as soon indeed as suppuration is established, as a spontaneous opening in these cases may be followed by urinary extravasation. In their earliest stages these abscesses may sometimes be aborted by the use of sedative lotions, with absolute rest in bed, moderate elevation of the organ, and free purgation. Leeches applied near them have never seemed to me to be of much benefit, and if applied directly over them usually aggravate the symptoms.

LYMPHANGEITIS rarely requires any special treatment. Evaporating and sedative lotions and rest will usually relieve any pain which may be associated with it.

BUBO may be aborted by the use of pressure or iodine, or, if these fail, may

be poulticed and opened as in any case of glandular suppuration. It is never a serious affection.

COWPERITIS requires rest, elevation of the buttocks, leeches to the perineum, hot sitz-baths, poultices, and prompt evacuation if suppuration occur.

PROSTATITIS, PROSTATO-CYSTITIS, and CYSTITIS must all be treated in very much the same manner. They are among the most annoying of all the complications of gonorrhœa, and demand prompt and careful attention. Upon the first development of the early symptoms—frequent urination, vesical tenesmus, etc.—the patient should be placed at absolute rest in the recumbent position, with the hips elevated upon a hair pillow; his diet for a few days should be limited to skimmed milk, of which he may take any desired quantity; an alkaline diuretic mixture (see p. 364) should be freely administered; three-ounce enemata of hot water, or of hot starch-water containing a few drops of laudanum, should be given every two or three hours; six or eight ounces of blood may, with advantage, be taken by leeches from the perineum, which should afterward be covered with hot fomentations; and finally opium, combined with belladonna or hyoscyamus in suppositories, should be used at bedtime, and at intervals during the night if the calls to urinate are frequent.

I have not found that, in these cases, a moderate degree of constipation is particularly hurtful, and any rectal impaction of feces is prevented by the daily enemata already recommended, so that the objection commonly urged against suppositories, that by reason of their constipating effect they do harm, need not prevent their free employment. On the other hand, by securing rest, enabling the patient to maintain the recumbent position for a longer time continuously, and diminishing the spasm of the vesical and prostatic muscles, they contribute largely to the cure of the inflammation. Bromide of lithium, in five-grain doses every three hours, or citrate of caffein, in three-grain doses, may be added to the diuretic mixture, if the urine remain scanty and high-colored.[1]

All urethral injections should be immediately stopped, and the patient should be instructed to resist as long as possible the desire to urinate, and also the inclination to strain and bear down at the end of the act. By this method of treatment, which, although vigorous, is not unnecessarily so, it is possible to abort many cases of commencing prostatitis, and sometimes even to have the patient upon his feet again in two or three days. If, however, the symptoms do not subside entirely in that time, the continuance of the recumbent position and the other details of treatment must be urgently insisted upon, as the least imprudence is almost sure to bring on a relapse. In certain subacute cases, the leeches and poultices may be omitted, or even occasionally the enemata and suppositories, but rest, elevation of the pelvis, restricted diet, and an alkaline diuretic, are always essentials of treatment.

RETENTION OF URINE.—If *retention of urine* should occur as an additional complication, the surgeon should not hastily introduce an instrument, as by so doing, no matter how carefully, he would probably intensify all the inflammatory symptoms. I have rarely seen a case uncomplicated with old stricture in which the bladder could not be emptied—or, rather, induced to empty itself—by the following plan of treatment: Quiet the mental anxiety and distress, which are invariably present, by assuring the patient that he is in no danger, and will shortly be relieved. Insert beneath the skin of the

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[1] Dr. Mracek (Allg. Wiener med. Wochenschr., No. 45, 1880) recommends chlorate of potassium, in divided doses of about four scruples daily, in cases of gonorrhœal cystitis.

perineum, by means of a hypodermic syringe, a quarter of a grain of morphia and $\frac{1}{120}$ grain of atropia, and repeat this in an hour if the retention persist. Place the patient in a hot bath, and keep him submerged to his chin until his urine begins to flow, or until he shows signs of syncope, in which case remove him and wrap him in blankets. If the heart's action remains irregular and alarms him, give a few drops of tincture of digitalis; if still unrelieved, place over the hypogastrium a large, mushy, hot hop poultice, covered with oiled silk, and renewed every two hours; give an enema of hot water and soapsuds, and after a time repeat the hot bath, or, if faintness is imminent, substitute a sitz-bath. By these means, patiently persisted in, catheterization can almost always be avoided.

If they fail, however, and the symptoms of retention and of distension of the bladder become serious, the urine should be drawn away with a Nélaton's catheter, using the greatest possible gentleness in its insertion. It must be understood that the evils of the gentle introduction of a soft catheter, even as often as twice daily, are less than those produced by the intense and almost continuous tenesmus which increases pelvic congestion, augments the prostatic and vesical inflammation, and causes almost unbearable suffering. Whenever, therefore, this condition is associated with dulness over the hypogastrium, and the hot bath, poultices, etc., fail to give relief, no further hesitation should be felt about resorting to catherization. Of course, if a tight stricture be present, and there is difficulty in introducing a soft instrument, others must be tried, and occasionally external urethrotomy or perineal section may become necessary; but the description of these cases and of the operations for their relief does not properly belong to this Article, and will be found elsewhere.

PROSTATIC ABSCESS.—When, during an attack of acute prostatitis, the patient suddenly has rigors followed by increased fever and sweating, it becomes probable that suppuration has occurred in the gland. This does not involve any change in treatment, but digital examination per rectum should now be made once or twice daily. If the abscess opens into the urethra, as it usually does, no special treatment is necessary; if it points towards the rectum, however, or if, with unmistakable symptoms of suppuration, the abscess shows no disposition to point in either of these directions, it becomes necessary to evacuate it, as it is very desirable that it be prevented from burrowing between the layers of perineal fascia and so finding its way into the perineum. If this unfortunately occurs, an incision should be made in the median line until the pus cavity is reached.

In opening a prostatic abscess through the rectum, the finger should search for a prominent swelling on the surface of the prostate, less resistant and more fluctuating than the rest of the gland. A curved bistoury may then be passed along the finger and the abscess incised. No subsequent treatment is necessary, except the free use of hot water enemata.

M. Terrillon calls attention to the importance of feeling for the pulsation of the hemorrhoidal arteries in such cases, and of avoiding them in making the incision. A fenestrated rectal speculum may be employed with advantage in performing this operation, the patient having been previously etherized.

CHRONIC PROSTATITIS.—When prostatitis becomes chronic, the treatment is difficult and prolonged. That which has proved most beneficial in my hands may be summarized as follows: removal of stricture, contracted meatus, phimosis, or other predisposing cause; restricted but nutritious diet; avoidance of all liquors, except some form of light red wine; careful attention to the bowels, cold water enemata once a day being often of great service; daily cool

hip-baths, of a temperature and duration governed by the sensations of the patient, and persisted in as long as they are followed by relief of subjective symptoms; counter-irritation to the perineum, preferably by iodine; normal exercise of the genital functions. Cauterization of the prostatic urethra is unquestionably useful in many cases, but should be employed only after these other measures have failed. A few drops of a thirty- or forty-grain solution of nitrate of silver should be deposited in the prostatic urethra, and the immediate effect, which is a more or less marked inflammatory action, watched and controlled by rest and appropriate remedies. The operation may be repeated if no benefit results from the first application.

Ergot, in combination with iodide of potassium, has been recommended in cases of chronic prostatitis, as tending to restore the contractility of the prostate, and, at the same time, to favor absorption of the plastic material deposited in it. When other remedies have failed, the application, once a week for six weeks or two months, of a gentle faradic current to the prostatic urethra, by means of a urethral electrode, is often sufficient to remove all symptoms. I have notes of three cases in which it has seemed to be the efficient agent in producing a cure, although other remedies were employed at the same time. Zeissl recommends,[1] in chronic prostatitis consecutive to gonorrhœa, that a full-sized sound be passed daily for several days, and allowed to remain for four or five minutes. He adds: "It is always preferable for beginners to employ a metallic catheter rather than a sound, as it is a source of great satisfaction to them to see the urine flow from the bladder, and not remain in painful doubt as to whether the instrument is actually in the bladder or has made a false passage."

EPIDIDYMITIS, at its onset, when there is a little thickening found at the posterior edge of the testicle, a feeling of weight and dragging along the cord, etc., but no great swelling, should be treated as follows: Put the patient to bed in the recumbent position; elevate the scrotum above the level of the thighs by means of a folded towel laid beneath it, or by a handkerchief, folded triangularly, and placed with the base beneath the scrotum, the apex and extremities being brought up and fastened to another going around the waist or pinned to the underclothes (the scroto-lumbar triangle of Mayor's handkerchief dressings). Apply directly over the painful testicle a piece of patent lint, soaked in the following lotion, with which it should be kept continually wet:—

> ℞.—Tinct. aconiti rad.,
>   Tinct. opii, āā f℥j.
>   Liq. plumbi subacet.,
>   Aquæ, āā f℥ij.   M.

Shave the hair from the groin on the affected side, and take about six ounces of blood, by means of leeches, along the line of the cord. Administer a half-bottle of the effervescing citrate of magnesium, place the patient on restricted diet, stop all urethral treatment, give him a drop of tincture of aconite and five grains of bromide of potassium every two hours, or more frequently if there be any febrile reaction, and then watch the case. Almost always—eight times out of ten, at least—this treatment at an early stage will prevent any further manifestations; the symptoms will subside, and in two or three days the patient may be permitted to walk around, keeping the testicle still enveloped in the lotion and well supported by a suspensory.

In the remaining cases swelling continues, the epididymis becomes larger, and the tunica vaginalis becomes distended with fluid. Prompt action will still serve to cut short the disease. In such a condition the scrotum of the inflamed side should be made tense by grasping it with the left hand, while

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[1] Medical Times and Gazette, February 21, 1880.

with a small sharp-pointed bistory, dipped into carbolized oil, three or four punctures are rapidly made to the depth of from a quarter to half an inch. A few drops of serum will usually spurt out, sometimes a considerable quantity. In either event almost immediate relief from pain is experienced by the patient, and a continuance of the previous treatment will result in rapid cure. I have never seen unpleasant consequences of any description follow this plan of treatment, although it is said in one instance to have caused profuse hemorrhage. The method of puncturing the tunica albuginea, has, however, in a number of cases, been the cause of hernia of the tubuli seminiferi, and occasionally of destruction of the organ.

When the swelling, either in spite of treatment or in its absence, has progressed to a considerable extent and the testicle presents a large solid mass, the pain having become dull and aching, and only severe upon motion or in walking, great relief may be obtained by the application of compression.

For *strapping a testicle*, the scrotum should be shaved, the testicle drawn down as far as possible, and a strip of adhesive plaster about half an inch in
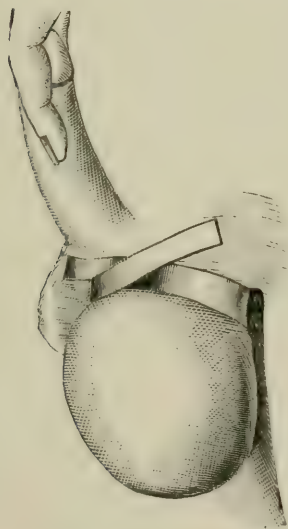
Fig. 325.   Fig. 326.
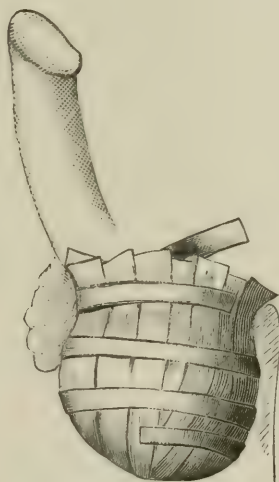
Strapping a testicle: application of the initial strap.   Testicle strapped.

width made to encircle it, so as to retain it in that position in the form of a tense tumor, pear-shaped and purplish in color (Fig. 325). This is then tightly covered in with successive strips of plaster (Fig. 326), placed first circularly until the greatest circumference of the tumor is reached and they refuse to adapt themselves neatly to the surface, and then longitudinally so as to cover in the lower segment completely. The testicle may then be placed in a suspensory bandage, and in most cases the patient is able to go about with little or no pain. The dressing should be replaced every day or two, as it will loosen as the swelling disappears. An ointment of belladonna and iodoform may then be applied upon a piece of lint worn beneath the suspensory.

The cases of trouble of various kinds, of failure to produce good results, of increased inflammation, etc., which have been reported to follow this

dressing, have, I believe, been due either to its improper and uneven application, or to its employment at too early a stage of the affection. I have now used it in so large a number of cases that I am enabled to speak of it with the utmost confidence as giving speedy, harmless, and almost invariable relief when neatly applied at the proper stage of the disease.

Of the very many other remedies which have been recommended in the treatment of epididymitis, I may mention the tobacco-poultice, a dressing made of fine cut tobacco and flaxseed meal mixed with hot water and laudanum, as of use in those cases in which cold applications cannot be borne. I must allude also to the benefit derived from the hypodermic injection of morphia in quantity sufficient to control the pain. In those exceptional cases in which this has become necessary in my hands, it has really seemed to have, to a certain extent, the positive curative action which has been claimed for it, the acute pain not returning even after the effect of the narcotic had worn off.

Lint soaked in a solution of nitrate of silver, one part to one hundred of water (Marc Girard); collodion as a means of compression (Bonnafont); ether applied on a piece of lint, and allowed to evaporate (Assadorian); friction with an ointment of antimony (Michel); injection of nitrate of silver into prostatic urethra (Boeck); iodoform ointment (Alvarez); puncture of the tunica vaginalis (Velpeau); puncture of the tunica albuginea and of the testicle itself (Vidal and Henry Smith); poultices of digitalis leaves (Besnier); pulsatilla, one drop of mother tincture every one or two hours (Piffard and Fox); ice applied in bladders (Diday); injection of morphia into tunica vaginalis, followed by strapping (Warren); oleate of mercury and morphia (Marshall); hypodermics of morphia alone (Milton); immersion in hot water followed by cold douche (Lloyd); nitrate of silver, 15 grains to the ounce (Jordan), are some of the measures recommended in this affection and enumerated by Bumstead in an excellent *résumé* in the American Practitioner for March, 1878.

Prof. Thiry, of Brussels, advocates[1] the use, in epididymitis, of strips of muslin covered with starch paste, and recommends their employment at the height of the acute stage, provided the general febrile disturbance has subsided.

An ointment of a drachm of iodoform to the ounce of vaseline is recommended in acute epididymitis by Dr. Sabadini, of Constantinople, and by Dr. Bourdeaux.[2]

The induration of the epididymis which remains after all inflammatory action has disappeared is usually permanent, and is not much affected by treatment. It may, however, diminish under the use of belladonna and mercurial ointment, and the internal administration of iodine and a mercurial. In cases of double epididymitis followed by sterility, it is well to pursue this method of treatment for a long period, as the re-establishment of the spermatic canal to ever so slight a degree is then, of course, a matter of great importance.

GONORRHŒAL RHEUMATISM has always been, and still is, considered to be a peculiarly obstinate and intractable form of joint-trouble, and treatment is pronounced, by all authorities upon the subject, to be in the highest degree unsatisfactory. The persistence of the swelling and inflammation, in spite of treatment, is always alluded to by such writers, and, although no average time is mentioned, it is evident that, in their experience, the disease has been a protracted one. I believe that it will necessarily be more or less so under any circumstances, but after a trial of all the various methods, local and general, which have from time to time been recommended, I am convinced that the results attained by adopting the following therapeutic measures are far superior to those following any other plan of treatment :—

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[1] Presse Médicale Belge, 1877.   [2] Archives Méd. Belges.

On the occurrence of joint-symptoms, place the patient immediately at rest, and limit the movements of the diseased articulation, which should first be freely painted with iodine, then enveloped in a layer of cotton wadding, and, finally, confined by means of a splint. Purge briskly with a saline cathartic, and after its action has ceased, place the patient at once upon full—almost heroic—doses of quinia and small—anti-plastic—doses of some mercurial, preferably the protiodide of mercury. The use of these latter remedies constitutes the essential element of this particular plan of treatment. The quinine should be given in ten-grain powders three or four times daily, or oftener, if the symptoms of cinchonism are not marked, and should be pushed to the fullest degree consistent with safety. The mercurial should be administered in doses of a quarter or a third of a grain four times daily, until the gums and posterior molars become slightly sensitive, when the dose may be somewhat reduced. At first, a hypodermic injection of a quarter of a grain of morphia may be given at bedtime, but this will not be necessary for more than a few days. The splint should be removed daily, and, after the first three or four days, gentle motion should be made in the joint, especially if it be the wrist, after which it should be painted with iodine and immobilized again. If the case is unusually obstinate, leeches around the joint may be required. The diet should be generous, and great attention must be paid to the condition of the digestive tract. Urethral treatment, if mild in character and not involving instrumental interference, may go on uninterruptedly, but I have found it better to avoid the passage of bougies, at least during the acute stage of the rheumatism. The disappearance of the swelling may be hastened by "strapping" the joint with adhesive plaster, something after the fashion of its use in epididymitis. This should not be done, however, until after the acute symptoms have subsided.

I now have notes of nine cases treated in this manner, the last six having been recorded with considerable detail, as I had become convinced of the great superiority of this treatment over all other methods with which I had had any experience. The average time required for the permanent relief of pain has been about one week, and in every case but one the functions of the joint have been partially re-established by the end of the second week, in a few cases almost completely so. I hardly hope to maintain this degree of success with a very large number of cases, but believe it to be so much better than that afforded by the salicylates, by iodide of potassium and colchicum, by blistering of the joint, etc., all of which methods I have repeatedly tried, that I shall certainly continue its employment, and now venture respectfully to recommend it to the profession.

According to Dr. Cameron,[1] "treatment produces little or no effect; the disease, when severe, is always very chronic, and marked throughout by a disposition to occasional amendments, followed by disappointing relapses. It is not surely assuming too much to say that the articular affection is probably excited by the absorption into the system of some form of septic poison." The same writer narrates two cases of multiple abscesses with well-developed pyæmic symptoms, one of them terminating fatally, following this variety of rheumatism.

Prof. Wm. H. Draper, of New York,[2] believes that the disease is a subacute rheumatism, and says he does not know "how he would distinguish it from an ordinary case of subacute rheumatism which was not associated with gonorrhœa." He adds, however: "It is the most obstinate, the most rebellious to treatment, of all forms of rheumatism; the most discouraging. . . . . Neither alkalies, nor salicylic acid, nor iodide of potassium, nor colchicum, nor any of the remedies that have been used in the treatment of rheumatism, seem to have any effect upon it"—thus, as it appears to

[1] Glasgow Medical Journal, February, 1881.
[2] Detroit Lancet, February, 1881.

me, himself noting a valuable diagnostic point between gonorrhœal and ordinary sub-acute rheumatism. Authorities might be multiplied very largely to prove that the affection is universally regarded as exceptionally intractable. Indeed, as far as I know, there is no difference of opinion as to this point.

Gosselin[1] recommends leeches, flexion of the joint, and hypodermic injection of morphia, but says that, under this treatment, the disease persists for from ninety to one hundred and twenty days, and frequently results in fibrinous exudation, destruction of the articular cartilages, and anchylosis.

GONORRHŒAL OPHTHALMIA is so closely allied to the preceding affection, and is so often associated with it, that it seems evident that the same general treatment would be likely to prove beneficial. I have had but two opportunities of testing this since adopting the method described above, and in neither of them was the result so conspicuously successful as to afford a basis for generalization, although I was inclined to think that the duration of the disease was somewhat shortened. In conjunction with the treatment by quinine and mercury, it would be proper in these cases to use warm collyria, to apply blisters or leeches to the temple, to keep the pupils dilated with atropia, and to use warm foot-baths, laxatives, sinapisms, and other revulsive measures.

CONJUNCTIVITIS, as a complication of gonorrhœa, is of so serious a nature, and the prognosis, in even the most favorable cases, is so grave that it is customary and advisable to call in the services of an oculist to share the responsibility. The general plan of treatment consists in placing the patient in a darkened room; hermetically sealing the sound eye to prevent infection; relieving tension, when chemosis is great, by free scarification of the conjunctiva; cauterization with the nitrate of silver; canthoplasty, to permit of the free escape of discharges; leeches to the temple; atropine; puncture of the anterior chamber when there is much increase of intraocular pressure; perfect cleanliness; and a general revulsive and antiphlogistic treatment.

Mr. Bader[2] recommends that an ointment, containing one grain of red oxide of mercury and one-fifth of a grain of sulphate of atropia to the drachm of vaseline, be used in case of gonorrhœal conjunctivitis. The eye should be first cleansed with tepid water, and the ointment then pushed freely beneath the upper and lower lids with a soft camel's-hair brush.

GONORRHŒA IN THE FEMALE.

Gonorrhœa in the female (Plate VI. Fig. 4) is neither as frequent, as limited in its situation, as protracted in its course, nor as serious in its results, as in the male. These facts, established by clinical observation, are due to the following causes: The anatomical arrangement of the genito-urinary organs in women, permits gonorrhœal inflammation to develop in the vulva, vagina, urethra, or uterus, which I have found to be involved with a frequency indicated by the order of mention. Vaginitis is, however, described by most writers as the most common of these varieties of gonorrhœa. The uterus is insensitive, not prone to inflammatory action from external irritants, and in a position where such irritants, especially when derived from sexual intercourse, are not retained in contact with it for any length of time. The delicate urethral mucous membrane is protected from frequent contamination by its sheltered position and its situation above the genital canal, fluids deposited in or flowing from the latter not necessarily coming in contact with it. The vulva and vagina are obviously much more exposed to irritating or traumatic

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[1] Gazette des Hôpitaux, No. 108, 1877.
[2] British Medical Journal, November 13, 1880.

agencies, any one of which, whether a purulent secretion from the male urethra, the use of violence, inordinate masturbation, etc., is capable of exciting in these parts a mucous inflammation whose characters are always practically the same whatever its etiology, the distinction between "simple" and "gonorrhœal" vulvitis or vaginitis being a purely imaginary one.

Even here, however, inflammatory troubles are much less frequently met with than is urethritis in the male, because—

(1) The vulva and vagina are protected by a membrane, thick, non-absorbent, usually well lubricated by the natural secretions of the parts, and often rendered extremely insensitive by continual friction.

(2) There are to be found in men almost none of the chronic discharges which are so common in women, and which cause the majority of cases of masculine gonorrhœa.

(3) It is almost impossible for a man with an acute urethritis, that is in the most contagious stage of the disorder, to have connection, the pain produced by erection being in itself a sufficient preventive. This is not true of women to anything like the same extent, prostitutes especially often plying their trade in disregard of the comparatively moderate pain of even an acute vaginitis.

(4) The organs of the female participate less actively and less completely in the physiological congestion of coitus—a powerful predisposing cause of inflammation.[1]

Vulvitis.

CAUSES.—Vulvitis may be produced in any of the ways mentioned, may be secondary to a vaginitis, may be due to worms, to the secretions of mucous patches, to uncleanliness and the accumulation of sebaceous matter, to the application of fatty ointments which have become rancid and irritating, to masturbation, to criminal violence, or to any other traumatic or infective cause. It is sometimes seen to arise spontaneously in infants during dentition, and is said, by Dupuytren, who cites cases in proof, to be occasionally epidemic among very young children. In either of these cases, the characters of the inflammation are in all respects indistinguishable from those of a vulvitis caused by purulent infection, an important medico-legal point which should never be lost sight of when, in such instances, suspicion points towards any particular individual as a possible source of contagion.

Vulvitis produced by masturbation is said to affect chiefly the clitoris; vulvitis caused by attempts at rape, the lower portions of the labia and the fourchette. This distinction, if it be of any value, can only apply to cases seen upon the first development of the disease, as, at a later period, the portions of the vulva originally unaffected are almost certain to be involved.

SYMPTOMS.—However caused, vulvitis begins with an itching sensation and a feeling of heat and burning, soon followed by tumefaction of the parts, which are bathed in a secretion, at first muco-purulent, then thick, yellowish or greenish, acrid and offensive. If the parts be inspected at this time, a day or two after the onset of the disease, the labia will be found red, abraded, and excoriated; and the nymphæ sometimes swollen so as to occlude almost completely the entrance to the vagina. The parts are sensitive to pressure, and painful upon motion, so that in severe cases, the only position in which comfort can be obtained is upon the back with the knees widely separated. The vulva is often surrounded by an area of congestion which extends beyond

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[1] See Jullien, op. cit., p. 255.

the vulvo-femoral folds and may be seen for some distance down the thigh, and which in chronic cases often becomes of a purplish or dusky brown color, looking like the pigmentation following an old syphiloderm, for which it should not be mistaken. The passage of the urine across the inflamed surfaces gives rise to an intense burning, which may be mistaken for the ardor urinæ of urethritis, and is often quite as severe.

COMPLICATIONS.—*Bubo.*—The inguinal glands are apt to be enlarged and tender, and sometimes suppurate. *Bubo* is, however, also less common in the female than in the male, and when it does occur, is almost always associated with this form of gonorrhœa, or with a urethritis.

The *sebaceous* and *muciparous follicles*, underlying the vulvar mucous membrane, which extends into and lines them, are frequently involved in the inflammation which spreads by continuity into their cavities, occludes their mouths by exudation into the submucous tissue, and causes them to project above the surface of the vulva as little elevations, visible to the sight and sensible to the touch.

Vulvo-vaginal Abscess.—In other cases inflammation follows the ducts of Bartholin's glands, and excites suppuration or abscess in these bodies, which are compound tubular glands, situated one on either side of the entrance of the vagina, surrounded by a fibrous envelope, and during sexual orgasm pouring into the vagina, just anterior to the hymen, a milky, albuminous fluid. In acute cases of this complication—vulvo-vaginal abscess (Plate VII. Fig. 4)—there are heat, pain, redness, and tenderness of the inflamed part; which signs, together with the peculiar pyriform swelling, serve to facilitate the recognition of the condition. In the early stages, the swelling can most readily be recognized by putting a finger in the vagina, and pressing outwards towards the ramus of the ischium. The abscess will sometimes evacute itself spontaneously through the duct of the gland, or at the inner surface of the nymphæ; or the pus may work its way between the layers of the ischio-pubic fascia, and escape just within the labium majus; but its cure can usually be hastened by a prompt and free incision made through the mucous membrane at the inner and lower aspect of the tumor. Suppuration in these glands has a peculiar tendency to recur, and the accumulation of pus and the consequent swelling will often take place, after a first attack, without any marked symptoms of inflammation. Under these circumstances—particularly if pressure on the tumor does not cause the appearance of pus at the orifice of the duct—it is possible, in exceptional cases, to mistake the condition for a pudendal hernia, for a cyst, for a hydrocle of the round ligament, or for œdema of the cellular tissue of the labium. The differential points in the diagnosis of vulvo-vaginal abscess from the three first-mentioned affections may be contrasted as follows:—

CHRONIC VULVO-VAGINAL ABSCESS.[1]	PUDENDAL HERNIA.	CYST OF THE LABIUM.	HYDROCELE OF THE ROUND LIGAMENT.
History of previous inflammation.	Sudden appearance.	Slow, painless growth.	No previous inflammation.

[1] Abscess of the vulvo-vaginal gland, which is very common in consequence of venereal excess, especially during menstruation, is also met with as a complication of mucous patches. In this case the labium of one side is swollen, œdematous, and deformed by an enlargement situated at the inferior part of the vulva. Fluctuation is readily felt beneath the skin, distended by the purulent fluid, and by puncture a considerable quantity of pus mixed with blood is discharged. The mucous glands which are seated below the urethra, in the vestibule, may also be inflamed, and form a small cup-shaped ulcer about one and a half millimetres in diameter; its margin is usually formed of normal mucous membrane.

CHRONIC VULVO-VAGINAL ABSCESS.	PUDENDAL HERNIA.	CYST OF THE LABIUM.	HYDROCELE OF THE ROUND LIGAMENT.
Swelling pyriform; base downward; greatest swelling inward.	Shape very similar, but greatest projection outward.	More distinctly circumscribed; sometimes pedunculated.	General, diffused swelling.
Fluctuation.	Doughy or elastic.	Elastic.	Doughy.
Irreducible.	Reducible by pressure near ramus of ischium.	Irreducible.	Partially reducible.
No impulse on coughing.	Distinct impulse.	No impulse.	No impulse.
Dull on percussion.	Resonant if an enterocele.	Dull.	Dull.
Most common in old prostitutes.	Seen at any age.	Seen at any age.	Seen oftenest in young persons.

Œdema of the vulva is usually symmetrical, and in every case in which I have observed it has either been a result of pregnancy or parturition, or of the presence of an abdominal tumor, or has accompanied a vulvitis, and was then of course easily recognized by the inflammatory symptoms.

Some interesting cases have been reported illustrating the possibility of contracting gonorrhœa from the pus secreted by abscesses of this character, which is squeezed out during intromission. In one instance no other disease of any kind was discoverable. It has been suggested also that these cases of chronic vulvo-vaginal abscess are those which not infrequently afford examples of the escape of certain individuals who have had connection with a woman known to have infected others at or about the same time. The abscess-cavity being emptied by the first person, those following him at short intervals are not exposed to contact with its irritating secretion, and consequently develop no disease.

Mucous Patches.—There is a form of vulvitis complicating mucous patches of the female genitals, which is due to contact with the labia of the oozing, offensive, puriform secretion of the syphilide. The condition is described by Cornil[1] as follows:—

"The internal surface of the labia minora is generally red, and the remains of the hymen are almost always swollen, and of a bright red color. The urethral and vaginal orifices are in a similar condition. The folds of mucous membrane forming the remains of the hymen and the upper part of the urethral opening are frequently the seat of red or pale, irregular elevations, resembling vegetations; these elevations are covered by very thick layers of the epidermis. The sebaceous glands of the labia minora are enlarged, and at their orifice is seen a small, opaque, white concretion, which may be forced out by pressure, measures about half a millimetre in length, and consists of epithelial cells. The vulvo-vaginal glands are frequently swollen, so that they are easily felt, attaining the size of a cherry-stone or more. By pressure there may be made to flow from their ducts a turbid, mucous fluid, which contains numerous pus corpuscles and filaments of mucus. When the inflammation is very intense, a few drops of this fluid are discharged from the duct, even in cases in which there is no abscess of the vulvo-vaginal gland; the discharge is due to a limited suppuration of the connective tissue surrounding the gland."

Vaginitis.—The vulvitis which accompanies vaginitis in non-syphilitic patients often occasions small red erosions, round or oval in form, and upon

[1] Syphilis : Its Morbid Anatomy, Diagnosis, and Treatment, p. 151. Translated by J. H. C. Simes, M.D., and J. Wm. White, M.D. Philadelphia, 1882.

the surface of which a desquamation of the most superficial epithelium occurs. These erosions are frequently bright red in color, and measure from two to eight millimetres in diameter, are painful, vary from two to six in number, and are seated within the labia majora between their base and the hymen. They do not cause a thickening of the corium, and the connective tissue of the mucous membrane remains pliant and normal, which distinguishes them from mucous patches. These very superficial erosions are especially found in the fold between the hymen and nymphæ, while mucous patches are found upon the labia. "In the Lourcine Hospital there are frequent opportunities to study vulvitis in its most simple form in the children from Sainte Thérèse ward, in whom there is no accompanying vaginitis; the redness, discharge, inflammation of the sebaceous and mucous glands, and erosions are the same as with girls arrived at puberty. In children, where the hymen is generally intact, this membrane, during vulvitis, is very red and swollen."[1]

Phlegmon.—In prostitutes of the lower class, vulvitis, neglected and allowed to spread unrestrained, or aggravated by continued coition, uncleanliness, retention and decomposition of the discharge in the folds of the labia, etc., occasionally gives rise to a *phlegmonous inflammation* of the subcutaneous and submucous cellular tissue, erysipelatous in its character, accompanied by serious constitutional disturbance, and usually resulting in diffuse suppuration, or in the formation of multiple abscesses. Such cases are never seen except in hospital wards, and usually occur in confirmed drunkards, whose habitual condition of stupor or semi-consciousness renders them insensible to the approaches of the male, which would otherwise cause great pain.

In one such case which fell under my notice, it was subsequently discovered that eight men and boys had, within an hour or two, used the person of the already diseased but not unwilling patient for the gratification of their sexual desires.

Nymphomania.—In the early stages and less severe forms of vulvitis, even with better classes of patients, there is often seen an increase of erotic impulses, sometimes amounting even to *nymphomania*, and inducing the patient, if she be a loose woman, to disregard all advice as to abstinence from coition, until the progress of the disease renders the act so painful as practically to preclude its performance.

CHRONIC VULVITIS.—When the disease becomes chronic, the most frequent and most noticeable symptoms are enlargement of the nymphæ, a purplish discoloration of the parts, an increased mucous and sebaceous secretion, often offensive, and a tendency to pruritus, which, when marked, is very distressing.

VAGINITIS.

CAUSES.—Vaginitis has for its most frequent cause a purulent discharge from the male urethra. In other words, gonorrhœa in the female is usually due to a similar disease in the male. The explanation of this fact has already been given (pp. 329, 330). It may, however, result from violent or excessive copulation, from masturbation, from contusions, from inflamed hemorrhoids, or in various other ways.

Thomas reports two cases in which vaginitis, having all the characteristics which he believes to belong to a specific variety, was developed by the accidental contact of chromic acid with the vaginal walls.

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[1] Cornil, op. cit., p. 152.

Females already affected with leucorrhœa sometimes develop a vaginitis after protracted exertion, and this is said to be particularly true of sewing girls who use the treadle of the sewing-machine for many hours daily. It may result from an extension upwards of a vulvitis, although the reverse is met with quite as often. Children and young girls are especially subject to inflammation of the vagina, which is sometimes found as a complication of dentition or of the eruptive fevers, and sometimes as a sequel of the first approaches of the male. In countries where early marriages are customary, it is not uncommon to hear of cases in which the husband has been wrongfully suspected of disease, on account of the occurrence of a "gonorrhœa" in the wife during the first few weeks of married life. Soon after puberty, the parts being small, the vulvo-vaginal outlet contracted, the mucous membrane tender, the orgasm and accompanying congestion very complete, the conditions are all favorable to the development of inflammatory troubles. It is for these reasons, as well as on account of their neglect of hygienic precautions, that young prostitutes are notoriously the most dangerous.

Dr. Matthews Duncan[1] describes diphtheritic, erysipelatous, ulcerous, and pustular forms of vaginitis. Exclusive of these varieties, he divides cases of vaginitis into two classes, (*a*) *local*, under which head he places those cases due to gonorrhœa, to violent sexual approaches, as in early marriage, to the introduction or use of pessaries, etc.; and (*b*) *constitutional*, in which, he says, there exists some predisposition, such as old age, alcoholism, lupus, diabetes, etc. The same writer, after considering the usual varieties of gonorrhœa in women, makes the following very judicious remarks upon the possible recognition of the cause in any given case of vaginitis:—

"Is it, in any special case, venereal or not venereal? You will, in practice, often be asked this question, and I advise you never to answer it explicitly. You cannot decide absolutely whether a case is venereal or not. At one time it was supposed that the discovery of trichomonads, or a leptothrix, or a vibrio, would decide whether it was venereal or not. But this is now given up. I have seen gonorrhœa which was certainly not venereal bear every character of the ordinary venereal disease. I do not say that there is no distinction, but only that the distinction cannot be made out by the practitioner so as to justify him, from his own inquiries into a case, in giving a decided opinion on the subject. Meantime, the distinctions of venereal gonorrhœa are simply marks of severity. It has been said that venereal gonorrhœa is infectious, while simple gonorrhœa is not; but I have seen every character that can be predicated of the one occur in the other, as I said before, including infection.

"What are the characters that make you suspect that a vaginitis is of venereal origin? It begins within a few days—generally two or three—of the infection; it is very severe, and runs an acute course; the secretion of pus is copious, beginning about the third day of the inflammation, and remaining copious for about a week or nine days. The vulva is generally affected, so that the woman has more or less difficulty in walking; and the vulva being affected, the inguinal glands are liable to be affected, and you may even have bubo. The urethra is affected, and also the bladder; there is liability to ovaritis and to perioophoritis; and there is the almost certain infection, not only by sexual intercourse, but by the matter touching any mucous surface, such as that of the eye."

Vaginitis, which is apt to be of a leucorrhœal character, sometimes occurs in the early stages of syphilis, as a result of the extension of inflammation from mucous patches seated upon the vulva, or of changes which take place in the os uteri. The neck of the uterus frequently undergoes certain alterations in the secondary stages of syphilis, which may be the medium of propagating inflammation to the vagina. According to Cornil:[2]—

"Quite frequently mucous patches, at first with an epithelial covering, afterwards eroded, appear upon the os uteri, one or two in number, or forming groups. The parts

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[1] Medical Times and Gazette, June 26, 1880. [2] Op. cit., p. 153.

of the os where the patches are situated lose their epithelium and are transformed into
ulcers. Very often, when mucous patches have not been observed, there is a slight
erosion of the orifice of the os, a muco-purulent catarrh of the neck, and a hypertrophy
of the entire organ, the neck especially becoming large and hard. This inflammation,
and this fibro-muscular hypertrophy of the neck, are certainly not always caused by
syphilis. But if the neck of the uterus in young girls affected with simple vaginitis,
who have never had children or miscarriages, is compared with that of girls of the same
age who are suffering with syphilis, it is at once very evident that the syphilitic patients
have the neck of the uterus enlarged and affected with a catarrhal inflammation; while
it is small and normal in simple vaginitis. The only lesion observed in the latter is the
redness of the vaginal mucous membrane continued over the os uteri. It may there-
fore be rationally concluded that the inflammation of the neck is sometimes directly due
to syphilis, as are vulvitis and vaginitis, without necessarily the presence of mucous
patches upon the neck."

SYMPTOMS AND COMPLICATIONS.—Vaginitis following purulent infection
usually begins at the lower and posterior aspect of the canal. It is at first
attended with a feeling of weight and fulness, sometimes referred to the
rectum, and with a dry, glazed, congested appearance of the mucous mem-
brane. Cases are described by Ricord and others, in which, through a con-
siderable period, this condition, which then involves the larger portion of the
vagina, obstinately persists, finally subsiding without the production of a
drop of discharge. I have never met with this variety of gonorrhœa, and if
it were not for the distinguished authority upon which it rests, would be-
lieve that a passive congestion, such as is often seen during pregnancy, or in
patients with uterine or other abdominal tumors, had been mistaken for a
vaginitis.

Usually after the lapse of a few hours a mucoid discharge appears, rapidly
becomes purulent, and, when the disease involves an increasing extent of
surface, as it generally does, is very profuse, soiling the posterior portion of
the patient's linen, and trickling down her thighs and over her perineum,
unless restrained by suitable dressings. The subjective symptoms, although
not often as marked as in vulvitis, are occasionally very characteristic, and
are due, in the first place, to the proximity of the bladder and rectum to the
inflamed canal, and in the second, to the nervous connections of the region
giving rise to certain reflex phenomena.

Under the first of these classes may be enumerated vesical irritability and
tenesmus, aching or throbbing pelvic or hypogastric pain, hemorrhoids,
dysenteric symptoms, prolapsus uteri, etc.; under the latter, sciatic, crural
lumbar, and abdominal pains, which last symptom, when it is observed in
hysterical women, and is associated, as it is then apt to be, with tympanitic
distension and apparent tenderness of the abdomen, may lead to the erroneous
diagnosis of *peritonitis*, a complication which actually occurs in a very small
number of cases. Its absence may be ascertained by attention to the pulse
and particularly to the temperature of the patient, and by powerfully attract-
ing her attention away from herself while at the same time firm pressure
is made upon the abdominal walls.

The same increase of *sexual desire* is found in these patients as in cases of
vulvitis, but to a much less marked degree. On the other hand, however,
coition is not usually attended with an equal amount of pain as when the
vulva is involved, and it is more easy for the woman to conceal the fact that
she is diseased; the temptation, therefore, either to yield to her impulses, or
to avoid pecuniary loss by continuing her occupation, is at least equally great,
and the enforcement of rest and of continence is quite as difficult.

Sometimes when the inflammation has been very intense and the discharge
has been retained, extensive though superficial *ulceration* of the vagina

occurs, the pus becomes mingled with blood, the pain is considerably increased, and the disease assumes a very obstinate and rebellious form.

CHRONIC VAGINITIS.—In the chronic variety of vaginitis the presence of the discharge, thickening of the vaginal mucous membrane, and enlargement of its papillæ, are almost the only symptoms to be met with. Now and then a case is seen in which the inflammation has become strictly localized, a small patch of strawberry red granulations being found, analogous to those seen in the urethra in chronic gonorrhœa, and on other mucous membranes, as the conjunctiva, where inflammation assumes this form.

Cases of chronic vaginitis in young persons are observed in which the vagina is hard and small, its rugæ well seen, but yet evidently swollen, œdematous, and with either no secretion or covered over by an old, grayish-white accumulation of epithelial detritus.

URETHRITIS.

CAUSES.—Urethritis in the female is commonly classed as a venereal affection, and is unquestionably due in a majority of cases to extension of inflammation from the vulva or vagina. As in such instances the original disease may, as has been shown, be entirely non-venereal in its origin, and as there are in addition certain forms of urethral inflammation associated with and dependent upon bladder disease, pregnancy, malposition of the uterus, etc., it is certainly very unsafe to assume that any woman with a urethritis has necessarily acquired it by contagion, and as a result of exposure to the discharge resulting from a similar inflammation in a person of the opposite sex.

Dr. S. F. Carpenter[1] reports a case of cysto-urethritis of three years' standing in a woman who was at the same time affected with hemorrhoids and pin-worms. Measures directed against these latter troubles resulted in a complete cure of the urinary disorder within two months, it having previously resisted many other methods of treatment.

It may be admitted, however, that the existence of a urethritis in a female is presumptive evidence of impure connection, particularly in those cases in which it exists independently of any vulvar or vaginal affection. When these regions are involved, the question of original causation reverts to them, as their inflammations almost invariably precede the urethral trouble.

As to the frequency of the forms of gonorrhœa thus described, there have been considerable differences of opinion among distinguished authorities. Belhomme and Martin found urethritis in 112 out of 1607 patients; Weibert recognized it in 29 out of 175 cases; Cullerier found it in one-fifth of his cases; Langlebert and Swediaur coincide in their observations and believe it to be very rare; on the other hand, Bell, Ricord, Guérin, Rollet, Berkeley Hill, and Bumstead, speak of it as a not infrequent complication. Sigmund found urethritis and vaginitis combined in 476 cases; vaginitis without urethritis in 282 cases, and urethritis alone without any concomitant inflammation in only five cases. Jullien gives the following table furnished to him by M. Fournier, from the service of the latter at the Lourcine.

Vaginitis,	.	.	.	.	.	.	.	.	.	176
Urethritis,	.	. · .	.	.	.	.	.	.	.	150
Vulvitis,	.	.	.	.	.	.	.	.	.	22
Urethro-vaginitis,	.	.	.	.	.	.	.	.	.	81
Urethro-vulvitis,	.	.	.	.	.	.	.	.	.	5
Total,										434

[1] Kansas Medical Index, July, 1881.

He explains the discrepancies by assuming that the authors who frequently observe urethritis include the chronic with the acute cases; but as chronic urethritis is quite rare in women, this hardly seems to me satisfactory. The explanation will hold good, however, when applied to what I have said (p. 390) on the relative frequency of vaginitis, vulvitis, etc. I have there alluded only to the acute varieties of these complications, and have, as I have said, found them to occur with equal frequency, or with vulvitis rather in excess. Inflammation of the vagina is so much more apt to become chronic than inflammation of the vulva, which rarely does so, that a table like the above gives a very unfair idea of the relative prevalence of these varieties of gonorrhœa as met with in recent cases.

Symptoms.—The shortness of the female urethra, its downward inclination from the neck of the bladder to the meatus, and the comparatively small amount of mucous membrane involved, prevent at the same time the formation of any large amount of discharge and the development of any extremely painful symptoms.

Ardor urinæ does exist in nearly all cases, and is sometimes quite marked, but has never in my experience been at all comparable in severity to the same symptom as observed in the male. The proximity of the inflamed area to the neck of the bladder renders some degree of involvement of that viscus quite common, but although urination may be much too frequent, the degree of tenesmus and the associated spasm and pain are less distressing than when cystitis occurs as a complication of male urethritis.

In many cases the spontaneous emptying of the urethra by gravitation, or its washing out by the stream of urine, is so complete, that to obtain evidence of the existence of a discharge it is necessary to insert a finger into the vaginal outlet and gently "strip" the urethra from behind forward, compressing it against the under surface of the pubic arch. This should be done some time after urination.

Occasionally the meatus will be found red, pouting, or everted, and it is sometimes surrounded by a ring of vegetations.

Jullien mentions the following diseases as possible sources of error in the diagnosis of urethritis in the female, giving with each its characteristic symptoms.

Vesical Neuralgia: Frequent and urgent calls to urinate; vesical tenesmus, each drop of urine provoking the most agonizing spasm; intense pain during catheterism; no discharge; urine limpid; usually associated with anal neuralgia; often occurs at a menstrual period.

Vesical Calculus: Relatively rare in women, and above all in young girls; antecedent history of gravel or gout; absence of discharge; vesical tenesmus; urine turbid or sanguinolent with heavy sediments; symptoms often intermittent; reflex pains in the thighs, lumbar regions, and genital apparatus; detection of calculus by vaginal examination.

Urethral Chancre: Easily seen if situated at the meatus; induration of the urethral wall recognized by palpation; discharge slight or absent.

Vascular Growths or Polypi of the Urethra: Less common with young unmarried girls than with married women; a pedunculated tumor easily seen when near the meatus; no purulent discharge; clear mucous hypersecretion; occasionally hemorrhage; if the size of the growth be considerable, great hyperæsthesia; intense pain in the vulva augmented by pressure or motion; a feeling of weight in same region; reflex lumbar and femoral neuralgias; ardor urinæ; painful coition; general health depreciated.

Uterine Gonorrhœa.

The form of uterine inflammation set up by gonorrhœa is usually *endocervicitis*. In nearly every case in which the upper portion of the vagina is

implicated in the disease, the os uteri is bathed almost constantly during the height of the inflammation in an acrid, irritating pus. It is not to be wondered at that in many cases the irritation thus engendered, instead of limiting itself to the production of congestion, abrasions, superficial ulcerations, and other changes in the os, extends into the neck and sometimes into the body of the uterus, producing in each instance its characteristic symptoms.

In the former case, there will be seen upon examination with a speculum, a red, swollen, ulcerated os, from between the lips of which protrudes an albuminous, mucous or muco-purulent discharge, viscid and coherent so that it is detached with difficulty. It does not differ in any respect from the discharge often found in weak, debilitated females, broken down after child-birth or for other reasons, and known as one of the varieties of leucorrhœa. When this discharge, which is neutral or alkaline, comes in contact with the acid secretions from the inflamed region, it coagulates, becomes milky, and is often found as semi-solid lumps mixed with the more fluid vaginal flow. The same change occurs in it when injections or suppositories of various astringents are used in treatment, and this new phenomenon often gives rise to considerable alarm on the part of the patient unless she has been told of it in advance.

When the disease extends to the lining membrane or to the body of the uterus itself, when it advances through the Fallopian tube to the peritoneal cavity or to the ovaries, or when in other cases it extends from the submucous connective tissue of the vagina to that which lines the pelvis, it produces complications which are of the most extreme gravity.

A description of metritis, ovaritis, peritonitis, or pelvic-cellulitis, when those affections result from gonorrhœa, would not differ in any way from that of the same conditions occurring idiopathically or as sequelæ of other diseases, and may be found more appropriately in the text-books on gynæcology.

TREATMENT OF GONORRHŒA IN WOMEN.

TREATMENT OF VULVITIS.—The speedy cure of a case of *vulvitis* depends upon attention to the following points :—

The patient should be placed at absolute rest with the pelvis elevated ; this is more important in this than in any other variety of female gonorrhœa, gravitation, and the friction produced by movement, operating powerfully and prejudicially if the patient insists upon going around. Perfect cleanliness and dryness of the parts are essentials of success in treatment. The labia should be gently washed every two hours with a strong solution of bicarbonate of sodium, which will dissolve and remove all accumulated sebum and mucus, and will at the same time often prove to be, in itself, a very soothing application. In using this, the labia should be gently separated with the thumb and fingers of one hand, while with the other a stream of the alkaline solution is squeezed out of a sponge held a short distance above. After this operation is completed, a soft old linen rag should be held in contact with the vulva until all the fluid is absorbed, the parts should be dusted with a fine powder of starch and oxide of zinc, or of opium and lycopodium, a piece of patent lint should be carefully interposed between the labia, and absolute quiet should be preserved until it is time to repeat the dressing. In certain cases the inflammation runs so high—the swelling, pain, and discharge are so excessive—that these gentle measures do not suffice. It will then be necessary to purge, to employ prolonged, general hot-baths—not sitz-baths—to follow them with a lotion of opium and lead-water kept contin-

ually on the inflamed region, or to paint the entire vulva with a forty-grain solution of nitrate of silver. This last expedient may be adopted earlier, and rarely fails to produce a good effect. When the burning and throbbing are very great, and particularly if there is some constitutional disturbance, the abstraction of blood by leeches placed along the lines of the groins, and on the perineum, is clearly indicated. The diet during this period should be restricted, consisting chiefly of milk and farinaceous articles.

When it becomes apparent that a *vulvo-vaginal gland* is involved, timely local bleeding may arrest the inflammation, but if it fail to do so, suppuration may be hastened by warm fomentations, cloths wrung out of hot water and laid over the affected labium being preferable to poultices. Some difference of opinion exists as to the best locality for evacuating the abscess if it fails to empty itself through the duct, but I have never seen any ill effects from making the incision on the inner and lower aspect of the swelling, and believe that it is possible to obtain the best drainage in that manner. It is asserted that the contact of the urine and other discharges with the wound at that point is objectionable, but this has not been so in my cases, and I have never taken any precaution to make the cut "valvular," or otherwise to protect it. In chronic, frequently recurring abscesses of this region, instead of dissecting out the capsule of the gland, as has been recommended, or of putting in a seton, I have always found it sufficient to lay open the cavity by a free incision, and to pack the wound with lint greased with carbolized oil. In some eight or nine cases thus treated, granulation has taken place from the bottom of the wound, and no recurrence of the abscess has followed.[1]

When superficial ulceration of the vulva results from vulvitis, and particularly when the ulcers are irritable and painful, iodoform often produces the happiest effect, reducing pain and at the same time stimulating the sores to healthy reparative action. In private practice, and with women who are delicate or sensitive about themselves, the odor of iodoform is often a serious objection to its employment. This odor cannot be altogether overcome, but the following formula has in my experience been the most satisfactory in that respect, the pungent, penetrating character of the smell being certainly agreeably modified.

R.—Iodoformi, ℨj.
Ol. ylang-ylang,
Ol. rosæ,
Ol. anisi, āā ℳv.
Unguent. aquæ ros. ℥ss.—M.

TREATMENT OF VAGINITIS.—Vaginitis requires the same general management as vulvitis—rest in bed, elevated buttocks, restricted diet, and attention to cleanliness being all valuable adjuvants to treatment. The confinement to bed is hardly so imperatively necessary as when the vulva is the seat of the disease; and motion does not through friction, or in any other way, so greatly aggravate the symptoms. The patient should, therefore, be particularly cautioned against undue exercise, and also against indulgence in sexual intercourse. In markedly inflammatory cases this will not be necessary, as the pain induced by attempts at intromission will be a sufficient preventive. In cases of acute vaginitis, with profuse purulent discharge, tumefaction of the mucous membrane, etc., the routine treatment should be as follows:—

[1] Dr. Matthews Duncan treats cases of vulvo-vaginal abscess by dilating the duct of the gland with a large probe, and injecting the abscess cavity with a twenty-grain solution of nitrate of silver by means of a lachrymal syringe (Medical Times and Gazette, February 21, 1880). In the Lancet, for March 3, 1877, he reported a case of persistent inflammation cured in this manner.

The patient, being in bed with the buttocks resting upon a hair pillow or a folded sheet, the bowels having been opened with a saline laxative, should be instructed to wash out the vagina every two hours with an injection of a pint or two of soap and water—or, if that prove irritating, with an alkaline solution—to follow this with a pint of simple water, and to conclude with the use of a pint of some medicated solution, preferably at this stage one of acetate of lead. This at first sight seems like a tedious and rather formidable procedure, but it is really very easy of accomplishment, and requires but a few moments for its performance. Before using the injection, the patient may, if she choose, move to a lounge, or preferably to an old blanket spread upon the floor. She should employ a Davidson's or Mattson's "family" syringe, using the long nozzle. This should be greased with a little cosmoline, and gently inserted into the vagina to its entire extent, the patient lying on her back with the heels drawn up to the buttocks. The rubber tube, to the end of which the leaden sinker is attached, should then be dropped into a basin of water, in which a piece of white Castile soap has been briskly stirred, or into one containing two or three teaspoonfuls of bicarbonate of sodium in solution. A bed-pan, a piece of rubber cloth, a big sponge—or, better still, some old muslin or flannel rags—being placed beneath the nates, so as to catch or absorb the overflow, the injection should be given in the usual manner, by regularly compressing the India-rubber bulb; after which, by a simple transference of the sinker to a basin or other vessel of clear water, the soap can be washed out, and the vagina thus prepared for the astringent or sedative solution which it is thought best to use. This, having been previously prepared in a wide-mouthed bottle, or another basin, may be given in the same way, and the syringe may then be withdrawn. After a very moderate experience the patient will be able to go through with this process in five or ten minutes, and with perfect comfort.

The materials used as injections are various, but belong chiefly to the classes of astringents and antiseptics. In the therapeutic value of the latter in the treatment of vaginitis I have no faith—permanganate of potassium, carbolic acid, Labarraque's solution, and others, having seemed to me to be of no more value, except possibly in correcting offensive odors, than as much cold water. I have used them in hospital practice in a sufficient number of cases to be able to pronounce upon this point with some positiveness. In the great majority of cases it will be found best to use at first the acetate of lead, to follow this, as the pain subsides and the inflammation becomes less acute, with alum or the acetate or sulphate of zinc; and when, under this treatment, the pain has entirely disappeared and the discharge has become watery, to pack the vagina with tannin, or to use suppositories, according to circumstances. In prescribing vaginal injections for women, it is always well to order the material in powder, telling the patient how much to dissolve in a given quantity of water. For use in a pint of water, for instance, she should employ of

Acetate of lead,	one teaspoonful—three drachms.
Acetate of zinc,	two teaspoonfuls—three drachms.
Sulphate of zinc,	one teaspoonful—two drachms.
Alum,	one teaspoonful—two drachms.
Tannin,	four teaspoonfuls—two drachms.

These should be diluted when it is found that they occasion pain.

The hot vaginal douche recommended so strongly in various gynæcological conditions by Dr. Emmet, of New York, will sometimes be found of great service in the treatment of vaginitis. Its use should, however, be limited strictly to those cases in which the patient herself recognizes its benefit, and should never be persisted in if it gives pain or is followed by increased fulness with throbbing of the parts; or, as in cases reported by

Dr. A. Reeves Jackson,[1] by intense arterial congestion. The temperature of the water should range from 100° to 110°, or even 120° F. In certain cases, especially of chronic vaginitis, Duncan[2] also recommends the use of the hot douche, large quantities of water at blood-heat being thrown into the vagina with considerable force.

If the patient be in good circumstances, the subsiding stage of a vaginitis will be best treated with vaginal suppositories, which may be used thrice daily, the supine position being observed for at least an hour after the introduction of each one. As examples of useful formulæ, the following may be given :—

R.—Ext. opii, gr. iij.
  Acidi tannici, ℨj.
  Ol. theobromæ, q. s.
M. et ft. suppositoria no. xij.

R.—Morphiæ sulphat. gr. iij.
  Liq. ferri subsulphat. f℥ij.
  Ol. theobromæ, q. s.
M. et ft. suppositoria no. xij.

R.—Pulv. aluminis,
  Cerat. plumbi subacet., āā ℨiij.
  Ol. theobromæ, q. s.
M. et ft. suppositoria no. xij.

In ordering these, the patient should be informed that they will stain her linen if allowed to come in contact with it.

In some women with whom oily applications prove objectionable, or in those too poor to use suppositories, it will be well to pack the vagina with strips of patent lint, into the meshes of which tannin or powdered alum has been rubbed. This must be done through a speculum, the instrument being gradually withdrawn as the vagina is filled. A T-bandage or ordinary napkin is then applied, and the dressing allowed to remain for twenty-four hours, or even longer if it does not become offensive at the end of that time. This is a very efficacious method of treatment, but is not as cleanly as the use of suppositories, and involves both more exposure of the patient and more labor on the part of the surgeon.

Occasionally, when the vagina remains irritable, raw, bleeding easily, and resenting the most gentle introduction of a speculum, it will be well to apply to its surface very thoroughly a strong solution of nitrate of silver, 40 to 60 grains to the ounce of water. This is best done by inserting a cylindrical spec-ulum, elevating its outer extremity, pouring into it two or three fluidrachms of the silver solution, and then gradually withdrawing it. As the vagina falls into the end of the tube, it will be thoroughly bathed in the liquid.

At night, in all cases of vaginitis, it will be found convenient to employ little pledgets of absorbent cotton into which some medicated powder has been rubbed. The patient should keep, on a chair or table beside the bed, two or three of these little rolls, and on waking during the night should insert one as far as the finger will carry it, first, of course, withdrawing the previous one. Lead, zinc, and tannin, may be used in this way, the former usually with the greatest advantage.

There are very few cases of vaginitis which will resist this general plan of treatment, and indeed I have never seen any, exclusive of those cases of long-continued vaginal catarrh in old prostitutes, which are practically in-curable on account of the habits of the patients.

Tonics, careful diet, sea-bathing, and continual abstinence from coitus, will be necessary now and then to remove the last vestiges of the disease, which will rarely give any further trouble.

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[1] St. Louis Clinical Record, June, 1879.   [2] Medical Times and Gazette, June 26, 1880.

TREATMENT OF URETHRITIS.—Urethritis in females, as a rule, runs its course very rapidly, and requires but little attention. Injections may be used by the surgeon, their strength being carefully adapted to the sensibility of the mucous membrane, and the almost certainty of their entering the bladder being remembered. The same principles of treatment hold good, and the same solutions are useful, as in urethritis in the male, lead, zinc, and silver being the substances preferred. Copaiba, cubebs, and sandal-wood oil may also be administered with advantage, acting as usual through the urine. No mention has been made of their employment in speaking of the treatment of other forms of female gonorrhœa, as in them the anti-blennorrhagics are worse than useless. Occasionally it may be necessary, in chronic cases, to wipe out the urethra with a probe wrapped in cotton and dipped in a solution of from 20 to 40 grains of nitrate of silver, and in some instances the solid stick has been employed.

TREATMENT OF UTERINE GONORRHŒA.—The affections of the *uterus* produced by gonorrhœa require no distinctive or peculiar therapeutic management. Nitrate of silver for abrasions, leeches for congestion, tampons or suppositories applied through a speculum and retained in contact with the os by elevation of the hips, iodoform, iodine, and all the well-known articles of the gynæcological armamentarium, are here as useful as in other uterine affections; and the same remark applies to the other pelvic and abdominal troubles which may complicate or follow a vaginitis.

GONORRHŒA IN ANOMALOUS SITUATIONS.

Gonorrhœa of the ear, mouth, nose, umbilicus, axillæ, and rectum has been described by various authors as constituting, in each instance, a distinct variety of the disease, arising from contagion. I may say at once that, having never met with a single instance of any of these complications, I have no belief in their existence; and a review of the literature of the subject but tends to confirm this skepticism. I will quote only a few of the best known authorities:—

Jullien[1] says : " We may pass by in silence the auricular, buccal, axillary, and umbilical varieties of gonorrhœa, which have not even been proved to be possible."
Berkeley Hill[2] has never seen such cases.
Bumstead[3] has never met with an instance of gonorrhœa of the rectum, and thinks that the existence of the other varieties " may well be doubted."
Lebert,[4] although expressing a belief in the existence of gonorrhœa of the rectum, does not say that he has ever seen such a case, and does not allude to any of the other supposed varieties.

In all these works we find quoted a single absurd case reported by A. M. Edwards,[5] of a widow who was affected with a serious catarrhal and ulcerative condition of the Schneiderian membrane, and who was discovered to have six months previously used a handkerchief supposed to have been contaminated by her son who was at that time suffering from gonorrhœa! Jullien,[6] in addition, mentions one or two mythical cases of nasal gonorrhœa—one reported by Andrew Duncan, in 1784, and one by Forçades, who attributed it to metastasis, and asserted that it was cured by reproducing the urethral discharge. Hecker, physician to the King of Prussia in 1787, describes

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[1] Op. cit., p. 212
[2] Op. cit., p. 585.
[3] Op. cit., p. 211.
[4] Ziemssen, op. cit., vol. viii. p. 808.
[5] Lancet, April 4, 1857.
[6] Op. cit., p. 209.

nasal gonorrhœa, but does not seem to have seen any cases, and apparently founds his description on that of Duncan.

Vidal (de Cassis)[1] quotes from Baumès the case of a workman, who, after kissing the vulva of a woman affected with gonorrhœa, developed an engorged, tumefied, red, hot, painful condition of the left half of the lower lip, with whitish granulations and a moderate purulent discharge. It developed six or eight days after the exposure to infection, and had already lasted six weeks when it came under observation. It obstinately resisted emollient treatment, as applied by M. Baumès.

Although there was, apparently, in this case, a direct relation of cause and effect between the gonorrhœal and the labial diseases, yet it does not follow that they were of the same character. Already existing mucous patches, inflamed by contact with irritant pus, or a severe form of herpetic ulceration, would be accompanied by all the above-mentioned symptoms, and would offer a much more satisfactory explanation of the phenomena.

Of course inflammation, eczematous irritation, or even suppuration, with abscess or ulceration, may occur at any time from contact of irritating or unhealthy pus with a delicate mucous membrane, and this is especially apt to be the case if the individual is broken down in health, poorly nourished, or of intemperate habits. But that gonorrhœal pus rarely if ever excites such action, must be evident, when we remember the numerous opportunities for observation enjoyed by the authorities quoted, none of whom appear to have seen a single authentic instance of these forms of infection.

In regard then to all the varieties except that affecting the rectum, we may conclude that there is an entire lack of satisfactory evidence that, as definite or recognizable affections, they ever exist. As to gonorrhœa of the rectum, the evidence appears to be a little stronger, but still far from convincing :—

Allingham[2] reports three cases, which he says were examples of undoubted gonorrhœa of the rectum, occurring in prostitutes who all confessed the manner in which they had become affected. The mucous membrane as seen through a speculum was intensely inflamed, but the inflammation did not appear to affect the submucous areolar tissue. In the fourth edition of Mr. Allingham's work (Philadelphia, 1882), I have been unable to find any report of these cases, and am compelled to believe that the author has purposely omitted them, possibly feeling some doubt as to their authenticity.

Tardieu[3] reports a case in which a copious greenish discharge occurred at the *anus* of a man after he had had unnatural relations with another who was affected with gonorrhœa, but I have been unable to find any description of the condition of the rectum.

Bumstead, Hill, and Lebert, as has been mentioned, have never seen a case of this kind.

Diday[4] has never met with any case, and after having experimented more than thirty times by conveying gonorrhœal matter to the nostrils, lips, and anuses of various patients, and having in each instance failed to produce any result, says that among extra-genital gonorrhœas he can only hold as indubitably proven the existence of one form—gonorrhœal conjunctivitis.

Jullien[5] describes an *anal* gonorrhœa, but says that experimental inoculation has proved that the disease cannot pass the limits of the muco-cutaneous orifice, where the cylindrical is replaced by pavement epithelium.

The symptoms which he details do not differ from those which I have many times seen produced by contact of gonorrhœal discharges with the anus, but have always attributed to a form of eczematous irritation. This occurs

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[1] Maladies Vénériennes, p. 188. 2e édition, Paris, 1855.
[2] Diseases of the Rectum, p. 237, edition of 1871.
[3] Étude médico-légale sur les attentats aux mœurs, p. 235, 6e éd. 1873.
[4] Op. cit., p. 129.   [5] Op. cit., p. 213.

chiefly in dirty and degraded prostitutes who are careless of personal clean-
liness, and who permit the vaginal discharges to flow over the perineal and
inter-gluteal regions. It is accompanied by the usual signs of dermatitis:
heat, redness, itching, vesiculation or pustulation—sometimes by actual ulce-
ration, which is most apt to occur in the folds of the anus and to follow
them upward, assuming a linear form, and becoming true fissures. It is often
associated with the formation of external hemorrhoids, and sometimes with
the development of warts, but has never appeared to me to have any peculiar
characters whatever, and has never, in the cases which I have seen, extended
up into the rectum. Cleanliness and zinc ointment, or some desiccant powder,
are usually speedily curative.

VENEREAL DISEASES: THE SIMPLE VENEREAL ULCER OR CHANCROID.

BY

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Synonyms.

French: *Chancroïde;* German: *Schanker.*

It was supposed, upon the acceptance of Bassereau's law of the difference in nature between the local venereal ulcer and the initial lesion of syphilis, and upon the consequent formation (although not by him) of the two schools of dualists and unicists, that all further doubts as to the characters of these two diseases had been entirely set at rest; but such would seem to be far from true. Later experiments with pus taken from various sources, throw serious question upon what had heretofore been considered as one of the strongest diagnostic points of the simple venereal ulcer, that is the capacity for auto-inoculation; and the existence of a virus for this form of venereal ulcer is at the present day, if not openly denied, at least openly doubted. To quote the words of a late authority upon this subject, one who was the first in this country to teach the doctrine of dualism, and the difference in the virus of chancroid and syphilis:—

" The chancroid . . . does not depend upon a specific virus of its own, incapable of being generated *de novo.* . . . If the view here advocated be the correct one, it suggests an interesting analogy with the history of our belief as regards the nature of gonorrhœa, an affection which in the last century was regarded as due to the syphilitic virus. Ricord finally adduced convincing proof that it had nothing to do with syphilis. It was afterwards supposed to depend upon a virus of its own—the gonorrhœal virus. We now know that it may be caused by any simple irritant, but more especially by the pus from the urethral and other inflamed mucous membranes, whether originating or not in contagion. Such as the history of gonorrhœa has been, so we predict the history of the chancroid will be."[1]

In view of such decided changes in opinion, I propose in this article to trace out the causes which have led to them, and, as far as is possible, to lay before my readers the views at present held by syphilographers upon this subject.

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[1] Bumstead and Taylor, Pathology and Treatment of Venereal Diseases. Fourth Edition. Philadelphia, 1879.

HISTORY AND NOMENCLATURE.

Until the year 1852, all venereal ulcers were regarded as due to the same cause—as produced by the same poison or virus—and were all called by the same name, viz., Primary Syphilis. It is true that Hunter, Ricord, and other less well known writers on venereal diseases, recognized the fact that only a certain proportion of ulcers of the genitals were indurated, and followed by subsequent manifestations elsewhere upon the body; yet the fact remains that the broad distinction of a difference in nature was not recognized, and that all these ulcerations, soft as well as hard, were grouped together under the common head of Syphilis. In the year mentioned, Bassereau, a pupil of Ricord, published a work[1] in which he openly advocated a difference in nature between these two varieties of venereal ulceration, and by a system of confrontation—that is, by tracing the lesion of any given patient to the person who gave it—he was enabled to formulate the following propositions:—

"Here, then, in a few words, are the conclusions at which I have arrived from confronting, not only those affected with erythema, but those also, the subjects of chancres and of syphilis of various forms, with the persons who infected them:—

"If a person who has been affected with chancres, followed by constitutional symptoms, is confronted with the person who gave the infection, or with those to whom it has been communicated, it will be found that all such, without exception, have been affected with chancres followed by constitutional manifestations. The chancre is never purely local.

"On the other hand, if one who is affected with a chancre which has not been followed by any syphilitic symptom, be confronted by the person who has caused the infection, the former will be found to be the bearer of a chancre which is entirely local, and which does not infect the constitution. This admits of no exceptions.

"Thus, no chancre which is followed by constitutional symptoms gives rise to a purely local sore, nor does a local chancre, by contagion, communicate an ulcer which is capable of producing syphilis."

Here we see clearly laid down the proposition that there are two distinct forms of ulcer, separate in their nature, and which never interchange, each producing its own kind; one of which is followed by constitutional symptoms, while the other never is so, but is always local.

There is no suggestion of a change in name as yet. That was reserved for another of Ricord's pupils, M. Clerc,[2] who, in 1854,[3] arrived at three conclusions:—

(1) That there are two well-marked varieties of syphilitic chancre: one indurated, which infects the entire organism; the second non-indurated, which does not infect the system, but is local and simple in nature.

(2) That each of these varieties of primary syphilitic ulcer transmits itself as a distinct pathological entity.

(3) That the simple chancre is the result of inoculation of the matter of an indurated chancre upon a person who either is suffering or has suffered from constitutional syphilis. Believing that it bore the same analogy to syphilis that varioloid did to smallpox, he gave it the name of "Chancroïde."

Here, then, it is that we first find the name, chancroid, appear—a name by which the lesion is as well known in America as it is in France.

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[1] Traité des Affections de la Peau symptomatiques de la Syphilis, pp. 197 *et seq.*
[2] I believe that this honor is claimed by M. Langlebert for M. Maratray, who, in a work, "De la Syphilis primitive ou locale et de l'unicité du Virus Syphilitique" (Paris, 1854), anticipated Clerc by six months.
[3] Du Chancroïde Syphilitique.

In 1857, three years after Clerc's article was published, M. Fournier edited, for Ricord, a book[1] in which the differences between the simple venereal ulcer (chancroid) and the initial lesion of syphilis (chancre) were acknowledged, and their diagnostic points of variance clearly laid down. Ricord, in other words, admitted that there were two kinds of venereal ulcer: the one local, non-constitutional; the other general, infecting the constitution, never local, but marking the beginning of syphilis. To quote his words : " Le chancre induré, Messieurs, est donc le prélude d'une diathèse, et cette diathèse, grosse de malheurs et d'orages, c'est la *vérole*, la *syphilis, lues venerea*." He acknowledged the two species, and adopted the name of chancroid.

In 1858, MM. Diday and Rollet, of Lyons, published an article in the "Annuaire de la Syphilis et des Maladies de la Peau," entitled "Y-a-t-il une ou deux espèces du chancre?" in which the following statements were formulated :—

(1) "There are two varieties of ulcer which are transmissible by close contact, as well as by inoculation artificially.

(2) "One of these is always local; the other infects the entire system.

(3) "The local variety, which bears only a superficial resemblance to the constitutional kind, is called ' Chancroid;' the constitutional ulcer is called ' Chancre.'

(4) "The two ulcers, when inoculated upon persons free from syphilis, produce each its own kind—chancroid a chancroid, chancre a chancre; but

(5) "If a syphilitic person, say a woman, have connection with a man who has a chancre, and an ulceration result, then this ulceration will assume mixed properties—it will have the softness and external characteristics of a chancroid; but on the other hand, with this ulcer as with a true chancre, the woman can communicate to another man a *chancre* which will produce in him the pox."[2]

Confusion worse confounded. But to still further complicate matters, M. Diday, in 1863,[3] proposed other changes in name. He wished to retain the word *chancre* for the initial lesion of syphilis, and to call the lesion which Clerc had christened "chancroid," "*chancrelle*," claiming that the name *chancroid* would be thus left to designate those ulcers due to the inoculation of the syphilitic virus upon persons already syphilitic.

" Cette terminologie [chancrelle] a de plus l'avantage de laisser le nom de *chancroïde* disponible pour désigner une lésion d'ailleurs très rigoureusement comparable à la varioloïde sous le rapport pathogénique : je veux dire la lésion que l'on voit naître de l'insertion du virus syphilitique sur un sujet qui a eu antérieurement la syphilis."[4]

Fortunately for medical literature, the name never was adopted, the words chancroid and chancre being those in common use to designate the two varieties of venereal ulcer.

In 1858, Rollet, of Lyons, published a work, "De la pluralité des Maladies Vénériennes," and in 1861 another one, "Recherches cliniques et expérimentales sur la syphilis, le chancre simple, et la blennorrhagie, etc.," in which, while admitting the existence of the chancroid as distinct from the initial lesion of syphilis, he claimed the existence of a third variety of ulcer, to

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[1] Leçons sur le Chancre, professés par le Docteur Ricord.
[2] To make this fifth clause as clear as the words of the writer can make it, and to remove the suspicion of error in translation, I append it here in the original French : " Mais si un sujet, une femme par example, qui était *antérieurement vérolée*, a eu des rapports avec un homme porteur de chancre, l'ulcère que celle-ci pourra contracter offrira des caractères mixtes ; il aura du chancroïde la mollesse et tout l'aspect extérieur, mais d'autre part, avec cet ulcère là, comme avec un vrai *chancre*, cette femme pourra communiquer à un autre homme un *chancre* qui produira ensuite en lui la vérole."
[3] Histoire naturelle de la Syphilis, Paris, 1863.
[4] Op. cit., p. 16.

which he gave the name of "mixed chancre." This lesion he endowed with a dual nature, for he says:—

> "Non seulement il y a mélange des matières contagieuses, lesquelles sont dès-lors susceptibles de transmettre les deux maladies dont elles proviennent; mais encore il peut y avoir inoculation des lésions syphilitiques par le pus du chancroïde, et transformation de ces lésions en autant d'ulcères réinoculables."[1]

He believed in an admixture of "virus" by inoculation, which was capable not only of transmitting a chancroid but of producing syphilis. This, to a certain extent, is true, but only as regards the period at which the inoculation is made, whether early or late in the duration of the ulcer; for if made early, as the chancroid has no true incubation, the result must and will be a chancroid; if made late, the lesion having changed its character and being no longer chancroidal but syphilitic, the result will be syphilis. Upon this point I shall take occasion to speak further when I come to consider the question of mixed chancre.

As far as the French and many American syphilographers are concerned, the matter stands as above stated, and the chancroid, mixed chancre, and chancre—that is, the initial lesion of syphilis—are at the present day accepted facts in venereal medicine. Among English and German writers there would appear to be some dissent to the above views. The former have taken a long time to recognize the existence of the two kinds of ulcer, and even at the present day are inclined to doubt their existence. Mr. Hutchinson, whose name is as respected in this country as in his own, writes in the Lancet as follows:—

> "The virus of syphilis may cause inflammation and result in ulceration and suppuration. Pus as produced is contagious, and this is my theory of all soft and non-infecting chancres. This pus does not necessarily contain specific germs of syphilis. It may or may not. If it does, the result is a *mixed* sore, which is very common. Dualists have not, and never had, the slightest basis for their creed. Chancres differ, it is true, but we have no duality of syphilis.[2] The soft sore is not syphilis, nor is it the offspring of a sister virus. The term dualism (if it means anything) I suppose must mean that there are two kinds of specific poison, each producing its specific results and incapable of transmutation or alliance. If my hypothesis is the true one, the soft sore is not the offspring of a specific virus, but is a side result from inflammation caused by it. If it were possible to exterminate all soft sores and destroy the secretions capable of producing them by contagion, we must expect in a few weeks again to find them reproduced."

Here then we find the belief that the *soft* sore, upon which I shall have something to say on a subsequent page, may or may not contain the germs of syphilis; a statement against which too strong a protest cannot be made, if by *soft* sore we are to understand the simple venereal ulcer or the *chancroid* of the French writers. Mr. Hutchinson is after all only repeating the teaching of the dualists MM. Clerc and Rollet.

The Germans, on the other hand, have with much wisdom never adopted the name chancroid, but have always called the non-constitutional ulcer "*schanker*," and what other nations call chancre they call "*initial sclerose*," or, better yet, "*initial läsion*." They accept the existence of two kinds of venereal ulcer, which differ in their nature, and which, in their purity, have nothing in common. By rejecting the name "chancroid," they have saved

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[1] Op. cit., p. 36.
[2] No dualist, as far as I know, has ever contended that we have; on the contrary, dualists candidly admit that there is but one syphilis, and that the initial lesion is its beginning. They do, however, claim that there are two kinds of ulcer: the one syphilis; the other not.

themselves from much confusion and trouble, as they have also done by never adopting to any extent the terms "soft sore," "soft chancre," and the like, which the French and English-speaking writers so frequently use. It would have been much better if the adjective *soft* had never been used in speaking of venereal ulcers, because its general use is to designate the simple venereal ulcer (chancroid), and when, as is sometimes the case, we find sores devoid of induration followed by the subsequent symptoms of syphilis, we lose sight of the fact that it is we, not the lesion, who have erred, and are prone to consider the division into simple and syphilitic ulcers a snare and a delusion. Induration of the initial lesion is *not a necessity in syphilis;* the initial lesion remains syphilis, even if it be soft; but an initial lesion never becomes a simple venereal ulcer, nor does this latter ever become syphilis.

The term "mixed chancre" is, in my opinion, another of those unfortunate names, only too common in the literature of the subject, which serve to confuse and bewilder the student of venereal diseases. In studying carefully the recorded cases of inoculation of this type of venereal ulcer, in the papers and larger works of Laroyenne, Rollet, Nodet, and many others, we are struck at once by two facts: (1) that the inoculations were made upon the bearers of the lesion, and not upon healthy persons; and (2) that the experiments were made at times when the chancroid was at full blast, even supposing, which is by no means certain, the initial induration to have shown itself; and that hence the inoculation could convey nothing but a local ulceration, for a second infection of syphilis does not occur while the first one is active. Hence those auto-inoculations show nothing to prove the conveyal of syphilis by the pus of a chancroid. Nor does confrontation in such cases show anything; the cases of Rollet, Nodet, Lindwurm, and others only show that the chancroidal pus can be deposited upon the initial lesion of syphilis, that it will there excite inflammatory and destructive action, and that it is capable of auto-inoculation. To thoroughly set this matter at rest, the pus of such ulcers should be inoculated upon subjects free from syphilis, and care should be taken not to have blood or any syphilitic secretions mixed with the pus; when, if the theory is correct that there is an admixture of virus, such persons should, in the first place, develop at the point inoculated a simple venereal ulcer (chancroid), and in the second place, at the proper time, the initial lesion of syphilis, followed by the subsequent development of the so-called secondary symptoms.

Curiously enough, this has been done, but with apparently another object in view than the one of settling the question of mixed chancre. The observation is reported by M. Melchior Robert, in his "Nouveau Traité des Maladies Vénériennes" (Paris, 1861). I give the case here in full, notwithstanding that it is defective in some of its details, because it is both instructive and interesting:—

"Madame J. was the subject of two cancerous ulcerations of the nose, one of the size of a franc piece, seated above the left nostril, the other, which was smaller, in a corresponding position on the right side. Both ulcers had begun eighteen months before as pruriginous nodules. Their surfaces were dry and of a grayish hue; their edges were very hard and salient; the auricular and submaxillary ganglia were not engorged.

"October 14. The larger ulcer was dressed with a layer of charpie which had been saturated with the pus of a chancre [that is, a simple venereal ulcer] from an inoculation recently made upon a patient affected with syphilis; this chancre originated in a simple ulceration.

"October 16. The inoculated ulcer suppurates abundantly and is reddened at its circumference. The other one remains dry.

"October 16 to 25. The peripheral inflammation has increased; the ulceration is extending; the floor of the ulcer is gray, the borders scalloped and undermined; secre-

tion is abundant, and the patient complains of severe heat and tingling in the part.   No glandular engorgement.

"November 1. The ulcer, which has evidently become transformed into a chancre [chancroid], is increasing in size.

"November 15. Obliteration of the edges, diminution of the inflammatory areola, and an inclination to granulation.

"November 25. Obliteration of the edges very pronounced; a narrow line of cicatricial tissue is commencing about the edges of the ulcer.

"November 30. Cicatrization progressing; a healthy granulation of the floor of the ulcer.

"December 15. The inoculated ulcer has partially cicatrized.   Dressings with aromatic wine are now ordered.   No sign of adenitis; no sign of infection.

"December 27. Complete cicatrization of the cancerous ulceration, with an ash-colored cicatrix.   The small ulcer at the right side of the nose has also healed.   No evidence of infection.

"The only dressings used were diachylon at the commencement and aromatic lotions at the end."

It is very much to be regretted that more details are not given as to the syphilitic patient from whom the pus of the "chancre of inoculation" was taken.   Still, let us see what the facts as given are.   We have a chancroid—for Melchior Robert did not recognize the difference between the two varieties of venereal sores, but called them all chancres—we have a chancroid, inoculated upon a syphilitic patient; pus from this chancroid of inoculation is then taken and placed upon an ulcerating cancer of the face, in a person presumably free from syphilis, though, unfortunately, this is not specified. What is the result?   A double infection?   It certainly ought to have been if there is any truth in this admixture of virus, in this "mixed chancre." But in place of any twofold disease we only have one, and that local, a simple venereal ulcer, without any systemic infection occurring after it.   And that is precisely what we should expect.   With our present knowledge, I cannot subscribe to the belief of an admixture of virus, but can only regard such "mixed" ulcers as the results of twofold or double infections, which, following out their proper, natural course, cause the chancroid to appear first, with its peculiarities of non-indurated base, purulent secretion, auto-inoculability, etc., this, after the period of incubation has elapsed, giving way to the initial lesion of syphilis, when the secretion gradually diminishes and becomes serous instead of purulent, the base assumes an induration which it did not have before, and the ulcer is no longer auto-inoculable, unless, perhaps, it is irritated into suppuration.   I shall revert to this point when I come to consider the subject of virus.

CHARACTERISTICS OF THE SIMPLE VENEREAL ULCER.

When the difference in nature between the two varieties of venereal ulcer, the simple ulcer (chancroid) and the initial lesion of syphilis (chancre), was formulated, attention was called to certain differences which obtained between the two, and which were considered as diagnostic; and it was taught that certain appearances were found in each one separately, which were not found in the other.   These peculiarities of the simple venereal ulcer I shall now discuss in detail, calling attention to the changes of opinion which have taken place since 1852.

THE SIMPLE VENEREAL ULCER IS NOT INDURATED.—The first and the most striking feature about this variety of venereal sore is the supple base upon

which it is seated.   The tissues upon which the ulcer is planted are entirely devoid of the induration which is generally found in the syphilitic variety; they are perfectly natural to the touch, except when this lesion is accompanied by very acute inflammation.   They are then infiltrated with serum, and the base of the ulcer has a brawny, doughy feeling, which may simulate the induration of the initial lesion of syphilis.   But a little care will prevent error, for the induration of the chancre has sharply defined limits, while the brawny base of the chancroid has not, but gradually loses itself in the surrounding tissues.   This œdematous condition is less likely to be confounded with the induration of syphilis than is another variety of infiltration not infrequently met with in chancroids, and more particularly those of long standing.   This infiltration closely resembles the parchment variety of induration, which is the only one likely to be confounded with it; but even here, in the large majority of cases, the educated fingers detect a want of clearness and sharpness of outline, which stamps it as something different from the " chancre à l'induration parcheminée."

Supposing, however, that the differential diagnosis should still be in doubt, auto-inoculation will settle the point, for this variety of ulcer is capable of reproduction upon the bearer of the lesion, the pus of the original sore giving rise to a similar sore by inoculation, while the secretions of syphilis are practically non-auto-inoculable.

In the very great majority of cases, however, the base of the chancroid is absolutely soft; hence formerly, and even now to a certain extent, this ulcer was called the " soft chancre," to distinguish it from the initial lesion of syphilis, which was called the " hard chancre."   But in time it was observed that some *soft* sores—very few, it is true, but nevertheless some—were followed by subsequent manifestations, and this revived the old dispute about the local nature of soft sores of the genitals.   The fault was really one of nomenclature, not one of the nature of the lesions under observation; hence the tendency among syphilographers is to abandon the terms "soft venereal ulcer" and "chancroid," while the ulcer which heretofore has been called "chancre" is now generally well known as the " initial lesion of syphilis."

THE SIMPLE VENEREAL ULCER HAS AN IRREGULAR FLOOR, AND IS ATTENDED WITH PROFUSE DISCHARGE.—The floor of this form of ulcer is one which differs from that of its congener.   If we bear in mind that the simple venereal ulcer is eminently destructive in its nature, and that wherever it gains entrance beneath the outer covering, be it skin or mucous membrane, its action is corrosive, while syphilis during its early stage is not, we shall at once see the reason for the irregular, worm-eaten appearance of the bottom of the ulcer, for the dirty-yellow exudation which lines it, and for the copious amount of pus which it secretes.   This is due to necrosis of the tissues, caused by what most syphilographers have, for want of more definite knowledge, called *the virus of the chancroid*, but which is probably nothing more than intense inflammatory action.   The walls of this simple venereal ulcer are worthy of notice: they are clean cut, judging from external appearances, giving the ulcer the look of being punched out of the tissues; but upon closer examination this clean-cut aspect is found to be only apparent, for the edges of the lesion are undermined.   This is owing to the tendency which all chancroids have to burrow, destroying tissue faster below the surface than above it; hence the real extent of these ulcers is usually larger than appears at a casual glance.

Here, then, are three important points in the physical aspect of the simple venereal ulcer, viz: the absence of induration of the base; the irregular yellow-looking floor, and the abundant secretion.   But there is one other

characteristic of the chancroid far more important than any yet mentioned, viz: its capacity for auto-inoculation.

THE SIMPLE VENEREAL ULCER IS AUTO-INOCULABLE.—Until very recently, this property was considered as peculiar to the simple venereal ulcer, no other kind of pus being deemed capable of inoculation upon the persons who bore the lesion from which the matter was taken. Later experiments have deprived the ulcer of this distinction, and yet I think the auto-inoculability of the chancroid is still a very important point, and of great value in the diagnosis of doubtful cases, even though the pus of non-venereal skin-affections, or of an artificially irritated initial lesion of syphilis, is occasionally susceptible of auto-inoculation. This property was correctly supposed to reside in the pus of the ulcer, and as no ordinary pus was considered to possess similar powers, the existence of a supposititious virus was invoked to account for the phenomenon. This convenient cloak for ignorance was termed the *specific virus of the chancroid*, and was believed to be the cause of the existence of the simple venereal ulcer, and to account for its virulence. Let us examine the more recent experiments which have been instituted upon this subject, and see what bearing they have upon the existence of a special chancroidal virus.

QUESTION OF THE VIRUS OF THE SIMPLE VENEREAL ULCER.—Ever since 1852, when Bassereau instituted his well-known confrontations, and when the diagnostic differences between the simple venereal ulcer and the initial lesion of syphilis were beginning to be recognized and better understood, innumerable inoculations and auto-inoculations have been made with chancroidal pus, and no fact in venereal medicine is better attested than this characteristic of the chancroid. But it was believed that only matter derived from the simple venereal ulcer was capable of auto-inoculation; and Ricord, in his "Lettres sur la Syphilis," says:—

"I have inoculated upon the same patient, and that a hundred times, the pus of a chancre,[1] the pus of balano-posthitis, the muco-pus of urethral blennorrhagia, the pus furnished by phlegmonous inflammations of other parts, and while the pus of the chancre invariably produced a chancre, the other kinds of pus remained of negative effect."

And the entire medical world has said " Amen" to this conclusion of Ricord. Recent experiments, however, have made us doubt the absolute correctness of this statement. In 1864 or 1865,[2] Dr. Pick, at the instigation of Zeissl, instituted in the hospital at Vienna some inoculations with pus taken from scabies, pemphigus, and acne pustules. The experiments were made upon syphilitic patients, and resulted in the production of pustules which were auto-inoculable for several generations, and did not in any way resemble indurated chancres. At the same time Pick made inoculations with the same pus upon the bearers of the lesion from which the matter was taken, and also upon other non-syphilitic patients, and they all proved negative.[3]

About the same time similar experiments were made by Drs. Kraus and

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[1] For "chancre" read "chancroid" wherever the word appears in the above extract; although this edition of Ricord's letters was published in 1863, as revised and corrected, it is but too evidently a copy of previous editions, taken from and written for the "Union Médicale" in 1850 and 1851.

[2] Bumstead, in his fourth edition, says it was in 1865. But in consulting Zeissl, Auspitz, and Reder, I am unable to fix the time more positively than I have given it above.

[3] Zeissl, Lehrbuch der Syphilis. Bd. i. S. 180 u. folg.

Reder at the Military Hospital at Vienna with pus of non-venereal eruptions. Here are the results ; I give them from Reder's work :—[1]

" Bærensprung believed that Bidenkap's[2] experiments lost much of their force from the fact that ulcerations of the skin could be produced upon syphilitic persons with ordinary pus, that is, with pus which was not obtained from chancres nor from syphilitic eruptions.

" Such inoculations, that is, with ordinary pus, were extensively made by Kraus and myself, and they showed that positive results were obtained only when the matter was taken from recent pustules. No inoculations succeeded when the matter was derived from long-standing pustules or from abscesses. The most marked results were those obtained from the matter of recent pustules in scabies pustulosa. As often as it was inoculated upon syphilitic patients, a pustule was developed at the point of inoculation, which was decidedly contagious during two or three generations, seldom more ; this pustule did not give rise to any ulcer beneath it, but simply to a moist superficial excoriation. This was equally the case whether the inoculations were made upon syphilitic eruptions or upon apparently sound portions of skin. Each of these experiments was controlled by and compared with other inoculations made upon healthy persons with the self-same matter, but every one of these latter experiments was negative."

Before going further, let us review the results furnished by these two sets of experiments. In both simple pus was inoculated upon syphilitic persons, and in both the results were positive, the inoculated matter producing pustules capable of still further auto-inoculation for two or three generations, and then ceasing. Certainly, as far as they go, the results tally with what we know about the auto-inoculability of the chancroid, except that these experiments were made upon persons whose skin and mucous membranes were made irritable by their disease (syphilis), and who were debilitated, and whose blood was altered from the same cause. (Witness the examinations of syphilitic blood made by Ricord, Grasse, and others.)

Now, if the same property resides in simple pus that we know belongs to chancroidal matter, the former ought to be inoculable upon healthy persons as much as are the latter. This is tried by all investigators, and in every instance the result is negative, showing that there is an element in the syphilitic skin favorable to inoculation which does not reside in the healthy skin. Is this due to syphilis? Pick thought so,[3] but it is not clear that Kraus and Reder shared this belief, although it would have been perfectly natural that they should do so.

The next series of experiments was made by an American physician, Dr. Edward Wigglesworth, of Boston, Mass., while resident in Vienna, Austria, during the winter of 1867–8. These experiments have never, as far as I know, been published by himself, and although Dr. W. made me acquainted with the facts some years ago, they never, I believe, appeared in print until 1879, when they were mentioned in the last edition of Dr. Bumstead's treatise,[4] from which I copy them. Dr. Wigglesworth wrote to Dr. Bumstead as follows :—

" I would state that I was free from all disease, whether hereditary or acquired, that I had never had a sore of any kind or any constitutional lesion of the skin or mucous membranes, and that I was merely a little run down from overwork in the hospital. I took from an acne pustule upon myself, pus, which I inoculated upon myself in three places, on the anterior radial aspect of my left forearm at the junction of the middle

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[1] Pathologie und Therapie der venerischen Krankheiten, S. 25 u. folg. Zweite Auflage. Wien, 1868.

[2] These were made with the secretion from the initial lesion and from mucous patches, about which I shall have something to say on a subsequent page.

[3] Ziessl, op. cit., Bd. 2, S. 56.   [4] Op. cit., Introduction, p. 29.

and upper thirds, first pricking open the apertures of hair follicles, and then rubbing the pus into them. The result in the course of three or four days was three well-marked pustules. From each of these I inoculated one new spot upon the same arm, nearer the wrist. The result was three new well-marked pustules. From each of the three second series I again inoculated fresh spots still nearer the wrist, and again the result was positive. The second series was hardly as well marked as the first, and the third series was slightly inferior in vigor to the second ; still all were well marked, the nine sores being at the same time upon my arm. On removal of the crusts, perceptible ulceration of the skin was found to exist. Zeissl, with whom I was studying at the time (1867–8), happened to be lecturing upon dualism, and requested me to show my arm to the class to prove the production of ulceration from properly inoculated simple pus. There were no buboes in my case, nor did the ulcerations require other treatment than exclusion from the air by means of a simple dressing and cleanliness. The scars remain to the present day."

The next experiments which I find recorded[1] are those made by M. Vidal, physician to the St. Louis Hospital, of Paris, which are published in the " Annales de Dermatologie et de Syphiligraphie" for 1872 and 1873, fourth year, page 350. He commences his article with the statement that in 1846, during his service as *interne* in the hospital of Tours, he had several times seen his " chef de service," Dr. Frederick Leclerc, inoculate the (pus) matter of ecthymatous pustules which were developed in the course of typhoid fever, upon the patients who had furnished the pustules. " These pustules," he says, " were frequently followed by the development of new pustules of ecthyma, identical with those from which the matter had been obtained." In 1852 and 1853, under the auspices of M. Vigla, and during an epidemic of typhoid fever, he undertook some fresh experiments. Two inoculations were made upon healthy men, who had never had typhoid fever, with pus taken from pustules of ecthyma in a typhoid fever patient. Both the inoculations were negative. The rest of the experiments were made upon the bearers of the ecthyma from whom the pus was obtained, and he asserts that in one-third of the cases he succeeded in producing pustules of inoculation. He does not give the number of the experiments which he made, nor the histories of the cases, except those of four patients. I give them here in some detail :—

CASE I.—R., aged 20, entered January 18, 1853, with an ataxo-adynamic typhoid fever of 15 days' duration. On January 26, an abundant eruption of ecthymatous pustules appeared upon the thighs, together with furuncles, an abscess on the chest, and the formation of a slough over the sacrum.

On February 3, pus was taken from one of the ecthymatous pustules of the thigh, and three inoculations were made upon the patient's left forearm. That same evening a slight redness appeared around two of the inoculated points. On February 4, the redness had extended, the skin was a little swollen, and a hard kernel could be felt. On the 5th, this had increased in size, and had commenced to point. On the 7th, four days after the inoculation, two perfectly characteristic pustules were seen, which dried up in 4 or 5 days. On the 8th, a fresh inoculation was made, and was successful. In this experiment Dr. E. Vidal introduced some dust and some of the patient's expectoration beneath the skin, in order to test the question whether it was simply irritation, or the pus-corpuscles themselves, which gave the successful issue to the experiment. These attempts were entirely unsuccessful.

CASE II.—In this case, on March 1, the 19th day of the disease, a cluster of ecthymatous pustules appeared upon the thigh. At the morning visit, an inoculation was made upon each arm. In the evening there was a slight redness at the inoculated points. On the 5th, the fourth day after the experiment, two very characteristic pus-

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[1] Although these experiments were professedly made in 1853, they were not published until 1873. Hence they are placed here, although they antedate Pick's experiments by eleven years.

tules were visible. On the same day, at 10 A. M., some pus was taken from one of these pustules of inoculation and inserted beneath the epidermis of the forearm. At 7.30 P. M. it had already formed a red papule which was slightly prominent.

"The patient's death, upon the next day," says Vidal, "prevented me from carrying out this new experiment, which I had already seen succeed several times; pus taken from the pustules of inoculation causing the generation of new pustules of identical character."

CASE III.—Ch., aged 19, entered February 1, 1853, being ill with typhoid fever of 15 days' duration. Blisters had been applied to the chest and the calves of the legs, and numerous furuncles and ecthymatous pustules were developed in the neighborhood. On the 7th of February, matter was taken from one of the ecthymatous pustules of the chest, and three punctures were made on the left arm at 10 A. M. At 7 P. M. there was redness, itching, and slight puffiness at the inoculated points. On the 8th, a slight prominence, with redness, was visible. On the 10th, the prominence was very marked, surmounted by a pustule which on the morrow, the fourth day, was very characteristic. The same day I took pus from the pustules by inoculation, and made a fresh inoculation upon the same arm. In the evening there was a slight redness and swelling. On the third day, a pustule similar to the one which furnished the matter had made its appearance. The first pustule had begun to desiccate, and on the 16th of February, nine days after its inoculation, it had completely disappeared. On the 16th, the new pustule inoculated on the 11th was in full suppuration. On the 20th inst. it had dried. The crusts in falling off revealed a cicatrix.

On March 2, at 10 A. M., I tried a new experiment upon the same patient: I took the matter from a large sanguineo-purulent pustule, resembling a pustule of ecthyma cachecticum, which had developed round a blister on the left calf. This I inoculated upon the left arm. At 8 o'clock that evening there was an elevation, attended with itching. On the 3d and 4th, the redness and swelling had become more pronounced. On the 5th, the apex contained a dirty serum. On the 6th, the fourth day after the inoculation, a very marked pustule, seated upon a deep red, indurated base, was seen. On the 7th, this pustule, the size of a pea, contained a greenish pus; the base was less indurated. On the 8th, it broke during the night and dried up. On the 9th, it was covered with a greenish crust; the indurated base was getting softer. On April 24, when the patient left the hospital, reddish cicatrices showed the points of inoculation.

CASE IV.—B., aged 29, entered the hospital October 3, 1861. The patient, who was of a lymphatic temperament, and subject during childhood to eruptions and frequent attacks of ophthalmia, had for the last three months suffered with an impetigo of the face and of the anterior portion of the chest.

This affection, which presented all the characteristics of a simple impetigo, commenced to heal, when, upon the external aspect of the right forearm, four pustules of simple ecthyma made their appearance. On the 19th of October, without waiting for complete suppuration, I charged the point of a pin with serum from one of these vesico-pustules, and made three inoculations upon the left arm. On the same evening, these three punctures were red, slightly swollen, and the seat of a smarting which attracted the patient's attention. On the 22d, the fourth day, three pustules had made their appearance. They consisted of a central phlyctenule, filled with a lemon-colored serum, and were seated upon a red, indurated base, surrounded by an areola. On the 23d, the pustules had changed into bullæ, which were not filled with pus. The contents were turbid. The mother pustule of the right arm, which had served for the inoculation, was covered with a crust, from beneath which serum exuded, which hardened upon exposure to the air.

On the same day (23d), an inoculation was made with matter from the young pustules, and a fresh inoculation with matter from the old ones. Besides these, three inoculations were made with ecthymatous matter which had been exposed to the vapor of the essential oil of turpentine. On the next day (24th), the following results were noted:
(1) The inoculations made with the matter from the original pustules in process of reparation had succeeded perfectly; the vesicles were prominent and their periphery red.
(2) Those made with matter from the pustules already inoculated, or of the second

generation, were less successful; the epidermis was elevated, but the red peripheral circle was slight. (3) Those made with matter which had been subjected to the vapor of the essential oil of turpentine were the poorest of all. The centre of the puncture was hardly raised, slightly papular; the reddish areola was almost entirely wanting, and the centre of this rudimentary vesicle was of a yellowish hue, a characteristic which the other inoculations did not present.

On the 25th (the seventh day), the pustules of the first inoculation had begun to dry; they were covered with a yellowish crust. The peripheral redness had disappeared, leaving a slight puffiness. On the 27th, inoculations were made with the matter from the second generation of pustules. These healed up rapidly, the punctures being marked on the following day by a slight prominence; the pustulation had aborted. A progressive decline in these inoculations was noticed; the last made were the first to heal. The capacity for inoculation diminished with each new generation, and the third one gave an insignificant result. Nevertheless, the subject did not lose the aptitude for inoculation, which was proved by new and characteristic pustules being obtained by inoculation of matter from the spontaneous pustules.

I have given these cases fully, because of the care and thoroughness with which they are reported, and because they are of great importance in their bearing upon this question of auto-inoculability. It must be borne in mind that, at the present day, it is believed that the simple venereal ulcer is the only lesion which possesses auto-inoculable pus, and this peculiarity has been claimed as of great importance in a diagnostic point of view. If, now, we can show any well-attested cases where simple pus—by that I mean pus not derived from a chancroid nor from syphilis—has been capable of auto-inoculation, the importance of auto-inoculation as regards the chancroid is very much diminished. Let us, then, review the cases just reported, and see what deductions we are justified in drawing from them.

In the German series, the cases of Pick, Kraus, and Reder, simple pus is inoculable only upon syphilitic patients, and upon no others; hence it is inoculable only upon a limited number of subjects, but upon them it is auto-inoculable for three generations.

In the American case, Dr. Wigglesworth's, no attempt is made to inoculate healthy persons, but simple pus is auto-inoculable for three generations upon the bearer of the lesion, who, previously to and at the time of the experiment, is free from syphilis or any venereal taint, but who is debilitated.

In the French series, Dr. Vidal's cases, simple pus is auto-inoculable upon the bearers of the lesion, who are presumably free from syphilis, but who are suffering from typhoid fever in three instances, and in the fourth from a sickly constitution. In all these cases one feature is especially noteworthy: the subjects of the experiments are below par in point of health. The part syphilis plays in this auto-inoculability is only a secondary one, because many other cases in which syphilis is absent show the same capacity.

What then is it which makes simple pus sometimes auto-inoculable? The pus? Not altogether, else why should it happen that healthy persons are impervious to its action? I grant that sufficient experiments have not yet been instituted upon this point to enable us to say positively that this is always the case, but, as far as our knowledge goes, the contrary remains to be proved. In one particular, then, chancroidal pus still retains its prominence, in that it requires no special soil for its propagation. But even here we must pause before committing ourselves to this statement. Is the chancroidal pus always capable of inoculation and auto-inoculation? Under certain circumstances, rare it is true, it would seem not to be so, as a glance at the annexed tables will show.

INOCULABILITY OF THE SIMPLE VENEREAL ULCER.

Table I.

(Ricord, Leçons sur le Chancre, p. 389.)

	No. of inoculations.	Positive.	Negative.
At period of progress	12	12	0
" " stasis	44	44	0
" " transition	9	9	0
" " repair, well established	12	9	3
" " " already advanced	3	3	0
" " " very far advanced	7	2	5
Gangrenous chancroid	1	0	1
Chancroid after deep cauterization	1	0	1

Table II.

(Labarthe, Le Chancre simple, p. 88.)

	No.	Positive	Negative
At period of progress	11	11	0
" " stasis	9	9	0
" " transition	4	4	0
" " reparation	16	16	0
" " advanced cicatrization	5	2	3

Table III.

(Millet, Étude statistique sur la Maladie syphilitique, le Chancre simple, et la Blennorrhagie, p. 59.)

	No.	Positive	Negative
At period of progress, stasis, etc.	75	75	0
" " repair	8	0	8

Table IV.

(Ricord, op. cit., p. 394.)

	No.	Positive	Negative
At period of progress and stasis	5	5	0
" " transition	2	2	0
" " repair	6	6	0

Résumé.

Number of inoculations made	230
With positive results	209
" negative results	21

All positive, during every stage except that of repair or of advanced cicatrization, where strength has been lost, where gangrene has destroyed the potency of the matter, or where it has been chemically altered by cauterization.

These inoculations, be it said, were made upon the bearers of the lesions and hence were auto-inoculations, but they show one point clearly, viz., that as they lose their inflammatory character they also lose their capacity for inoculation, and here is I believe the true explanation of the "chancroidal virus"—it is *inflammation*. Irritate a non-venereal pustule; excite it to inflammatory action, and I believe its pus will be capable of inoculation, in the same way that Mr. Lee, of London, rendered the secretion of the initial lesion of syphilis (usually not auto-inoculable) inoculable upon the bearer of the lesion. Until, however, that is done, it would be mere theory to say that it is possible, nor should we be justified in deducing any conclusions therefrom, but we can say this much:—

I. Auto-inoculation is not peculiar to, nor pathognomonic of, the pus of the simple venereal ulcer (chancroid).

II. Simple pus is, under certain circumstances, capable of auto-inoculation.

III. This auto-inoculability is partially due to irritative inflammation affecting the pus, and partially to irritability of the tissues.

If now the above conclusions are accepted, what becomes of the "specific virus?" Would it not be better to drop it out of our vocabulary altogether, unless indeed we are ready to admit that simple pus is endowed with a specific virus which renders it auto-inoculable?

THE SIMPLE VENEREAL ULCER IS ORDINARILY MULTIPLE.—Another feature of the simple venereal ulcer is its multiplicity, due to two causes, the first and most important one being auto-inoculation, the second and least important being immediate contagion. When the contagious nature of this form of ulcer is remembered, it will not be deemed surprising that multiplicity is the rule rather than the exception, and this feature, when compared with the singleness of the initial lesion, is one of consequence.

The appended tables will show not only the tendency toward multiplicity which marks the simple venereal ulcer, but also the difference which exists in this respect between it and the initial lesion of syphilis. These tables are so suggestive that a few lines devoted to their teaching will not be wasted.

MULTIPLICITY OF THE SIMPLE VENEREAL ULCER AS COMPARED WITH THE INITIAL LESION OF SYPHILIS.

Table V.

(Ricord, op. cit., p. 34.)

Persons affected with simple chancres	254
" " " one chancre	48
" " " several chancres	206
In the following ratio :—	
Patients with two	32
" " three to six	116
" " six to ten	41
" " ten to fifteen	8
" " fifteen to twenty	4
" " twenty or more[1]	5
	———
	206

Table VI.

(Fournier, Nouveau Dictionnaire de Médecine et de Chirurgie pratiques, 1867. Art. Chancre, p. 86.)

Patients affected with simple chancres	329[2]
" " " one chancre	63
" " " several chancres	266
In the following ratio :—	
Patients with two	50
" " three to six	152
" " six to ten	45
" " ten to fifteen	8
" " fifteen to twenty	5
" " twenty to twenty-five	6
	———
	266

Table VII.

(Debauge, Traitement des Chancres simples par la Cautérisation au Chlorure de zinc. Paris, 1858.)

Patients affected with simple chancres	118
" " " one chancre	50
" " " several chancres	68
In the following ratio :—	
Patients with two	22
" " four	11
" " six	11
" " six to ten	17
" " eleven to fifteen	6
" " twenty	1
	———
	68

[1] M. Labarthe, in his thesis, "Le Chancre simple," speaks of having seen in 1868, in M. Fournier's wards in Lourcine, a woman who was the bearer of the prodigious number of seventy-five chancroids.

[2] In the article from which this is copied the figure is 327. As this is evidently erroneous, I have taken the liberty of changing it.

Table VIII.

(Sturgis, Records of Third Venereal Division, Charity Hospital, Blackwell's Island,
New York, 1879–80.)

Patients affected with simple chancres	249
" " " one chancre	104
" " " several chancres	145
In the following ratio :—	
Patients with two	71
" " three	38
" " four	20
" " five	6
" " six or more[1]	10
	145

Table IX.

(Ricord, op. cit., p. 121.)

Patients affected with indurated chancres	456
" " " one chancre	341
" " " several chancres	115
In the following ratio :—	
Patients with two	86
" " three	20
" " four	5
" " five	2
" " six	1
" " nineteen	1
	115

Table X.

(Sturgis, Records of Third Venereal Division, Charity Hospital, 1879–80.)

Patients affected with indurated chancres	46
" " " one chancre	45
" " " several chancres	1
In the following ratio :—	
Patients with one	45
" " two	1
	46

Résumé.

Number of patients having chancroids		950
" " " a single lesion	265	
" " " multiple lesions	685	
" " " indurated chancres		502
" " " a single lesion	386	
" " " multiple lesions	116	
Percentages of multiple chancroid to total number		72.1
" single " " "		27.9
" multiple initial lesions to total number		23.1
" single " " "		76.9

The small number of initial lesions in my tables is, I believe, due to the fact that in this city few patients enter hospital until the subsequent lesions of syphilis have declared themselves, and prefer to seek relief at the dispensaries for the initial lesion. In support of this statement, I would refer the reader to Tables XXXIV. and XXXV., p. 440.

The collated cases of the simple venereal ulcer amount to 950, of which number 685 were multiple, and 265 were single, or, to express it in percentages, the simple venereal ulcer is multiple in a little more than 72 per cent. of the total number of cases. Even this is probably under the number,

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[1] Under this heading one patient had twenty-five chancroidal ulcers.

because in the table of my own cases many patients who are recorded under the heading of "affected with one," evidently had been, from the histories, the bearers of multiple lesions at the commencement of their cases, coalescence having converted their multiple sores into single large ulcers, when, as they presented only *single* lesions on their entrance into the hospital, they were so recorded.

With the initial lesion of syphilis this is different. Here the tables show the proportion of multiple ulcers to the whole number of cases to be only a little more than twenty-three per cent., or, if it be expressed in numbers, the initial lesion is multiple 116 times, and single 386 times, in 502 cases.

Hence, although not invariably, it may be generally assumed that multiplicity of lesions is the characteristic of the simple venereal ulcer as contrasted with the initial lesion of syphilis, and especially is this the case when the multiplicity occurs subsequent to and not at the time of coitus.

The Simple Venereal Ulcer has no Period of Incubation.—In the simple venereal ulcer there is another peculiarity which serves to distinguish it from the initial lesion of syphilis. When the pus comes in contact with mucous membranes or cuticle denuded of their epithelium, its action is produced at once—often within twenty-four hours after the matter has been deposited upon the tissues. Only exceptionally is its action delayed beyond the first seven or eight days after coitus, and then only if the matter is concealed in a follicle, or in a fold of the skin, which, from offering greater resistance to the action of the pus, delays the appearance of the ulceration. Hence we are accustomed to speak of this ulcer as being devoid of any period of incubation. Its action is immediate, subject only to the delay offered by the mechanical resistance of the tissues.

If now we examine the following tables we will see that in 381 cases, in which we have accurate information as to the time of its appearance, the simple venereal ulcer appeared within the first eight days in 310, and only in 71 cases subsequent to that time, and these instances of prolonged incubation are probably explicable upon the ground that the patients themselves were at fault as to dates[1]—inasmuch as in several cases the ulcer had evidently been of long duration at the time when the patient stated he had first seen it—or else that the pus had been deposited upon some tissue which resisted its action for a length of time. At any rate, it is a significant fact that 310 of the 381 cases occurred within the first eight days after coitus.

Time of Appearance of Simple Venereal Ulcer.

Table XI.

(Millet, op. cit., p. 54.)

The simple chancre appeared from abrasion during coitus in . . .	10 cases.
It was seen from one to three days after coitus in	52 "
From four to six days after coitus in	48 "
In eight days " "	53 "
" fifteen days " "	3 "
" twenty days " "	5 "
" forty-five days " "	1 case.
" sixty days " "	1 "
Dates are wanting in	28 cases.
Total	201 "

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[1] In 48 out of 429 cases the data are so defective as to be of no value. See Tables XI. and XIII.

Table XII.

(Fournier, op. cit., p. 81.)

The chancroid was seen on the first day after the infecting coitus in . . 6 cases.
On the second day in . . . . 2 "
" third " . . . . 9 "
From the third to the fourth day in . . . . 4 "
On the fourth day in . . . . 3 "
" fifth " . . . . 1 case.
" sixth " . . . . 3 cases.
From the seventh to the eighth day in . . . . . . 13 "
On the ninth day in . . . . 1 case.
" tenth " . . . . 2 cases.
" eleventh " . . . . 1 case.
" thirteenth " . . . . 2 cases.
From the thirteenth to the fifteenth day in . . . . . 3 "
" seventeenth to the twentieth day in . . . . . 2 "

Total . . . . 52 "

Table XIII.

(Sturgis, Records Third Venereal Division, Charity Hospital, Blackwell's Island, N. Y., 1879–80.)

Chancroid seen 1st day after coitus in . . . . 5 cases.
" " 2d " " " . . . . 4 "
" " 3d " " " . . . . 2 "
" " 4th " " " . . . . 5 "
" " 5th " " " . . . . 6 "
" " 6th " " " . . . . 4 "
" " 7th " " " . . . . 12 "
" " 8th " " " . . . . 9 "
" " 9th " " " . . . . 5 "
" " 10th " " " . . . . 10 "
" " 11th " " " . . . . 1 case.
" " 12th " " " . . . . 2 cases.
" " 14th " " " . . . . 8 "
" " 18th " " " . . . . 2 "
No positive data could be obtained in . . . . . . 20 "

Total . . . . . . 95 "

Table XIV.

(Debauge, op. cit., p. 21.)

The chancroid seen in less than 24 hours in . . . . . 6 cases.
" " " " two days in . . . . 5 "
" " " " three " . . . . 10 "
" " " " four " . . . . 5 "
" " " " five " . . . . 5 "
" " " " six " . . . . 3 "
" " " " seven " . . . . 1 case.
" " " " eight " . . . . 24 cases.
" " " " ten " . . . . 2 "
" " " " twelve " . . . . 11 "
" " " " fifteen " . . . . 7 "
" " " " seventeen " . . . . 1 case.
" " " " three weeks in . . . . 1 "

Total . . . . . 81 cases.

Résumé.

Total number recorded . . . . 429 cases.
Of these, positive dates are given in . . . . 381 "
Data are uncertain in . . . . 48 "
Of these 381 positive cases, the chancroid was seen within 8 days after coitus in 310 "
After that time in . . . . 71 "
Of the 310 cases seen within 8 days after coitus, the chancroid appeared
within 3 days after infection in . . . . 111 "
Or, expressed in percentages, the chancroid appeared within 8 days after
coitus in 81.3 per cent. of the cases in which the data are positive.

Varieties of the Simple Venereal Ulcer.

According to the appearances which the chancroid presents during the different stages of its progress, it has received a variety of names, to wit: the follicular, the herpetiform, the ecthymatous, the ulcus elevatum, and the exulcerous. This multiplicity of names is to be regretted, as liable to produce confusion, and to obscure the fact that the lesions to which they are applied are accidents in the course of the disease, rather than well-defined varieties of the ulcer.

Thus, when the matter of a chancroid is deposited within a *follicle*, its first appearance is as a small nodule surmounted by a slight depression, with a grayish floor. This nodule is due to the distended follicle, and the depressed apex corresponds to the mouth of the duct of the follicle. It should be borne in mind that the small ulcer does not represent the real extent of the chancroid, inasmuch as the destructive action has been advancing more rapidly in the interior of the follicle than appears externally, and that hence these follicular chancroids should be laid open prior to cauterization, so as to allow of a thorough destruction of the ulcer.

The *herpetiform chancroid* is simply one which is seen very early in its course, before the contents of the vesicle have become purulent, and is apt to lead to error by causing the chancroid to be mistaken for a simple attack of herpes. Its subsequent course differs in no respect from that of an ordinary chancroid.

The *ecthymatous chancroid* is simply one which has been covered with a crust by the drying of the secretion from exposure to the air. Removal of the crust reveals all the usual characteristics of the ulcer.

The *ulcus elevatum* has been a source of much confusion, owing to its simulating the initial lesion of syphilis. It is due to causes which have already been discussed in a previous portion of this article. This ulcer is usually attended with marked inflammation and exudation about the base, which cause an elevation of the tissue upon the apex of which the ulceration is seated; hence the name. As the inflammation subsides the elevation becomes flattened, and the ulcer in its subsequent course exhibits all the characteristics of the chancroid.

The *exulcerous chancroid* is a superficial chancroid, in which from the feebleness of the inflammation the destructive action is very slight, the edges are hardly undermined, and the secretion is scanty instead of being abundant. Indeed, to all intents and purposes this ulceration is a chancroid which is incapable of extension, and which resembles in many respects an acute erosion of balanitis. It is hardly deserving of the separate classification accorded it by M. Clerc.

Locality of the Simple Venereal Ulcer.

Until within a few years it was believed that certain regions of the body were exempt from being the seat of the simple venereal ulcer. Indeed, Ricord, as lately as in 1860, taught the following doctrine: "Up to the present there is no well-authenticated case of a soft chancre [that is, a chancroid] developed upon the face, or, to put it in more general terms, of a cephalic soft chancre."[1] Later experience, however, proves that cephalic chancroids do occur in sufficient number to demonstrate their existence, and to permit us to take exception to Ricord's formulated teaching given above.

[1] Leçons sur le Chancre, p. 18.

PLATE VIII.

Chancroids.

But before taking up this question of cephalic chancroid, let us see upon what portions of the body the simple chancre is most likely to occur. Upon turning to the tables bearing upon this point, we observe that out of a total number of 1271 cases in the male, 1194 occur upon the genitals, and of these, 826 are recorded as occurring upon the glans penis, upon the prepuce, upon the fossa glandis, and upon the sheath of the penis; 24 at the meatus urinarius; 9 within the urethra; 9 upon the scrotum; 3 about the anus; 3 on the finger; 5 upon the leg; 1 on the anterior thoracic region; and 1 on the nates. In the female we have the following record: the external genitals were the seat of the simple venereal ulcer in 185 cases; the meatus urinarius and its vicinity, and the urethra, in 26 cases; the vagina in 68 cases. The lesion was situated at the margin of the anus in 33 cases; at the inter-crural angle in 5 cases; on the perineum in 7 cases; on the inner aspect of the thighs and upon the hypogastrium in 7 cases; on the cervix uteri alone in 1 case, and on the fourchette and cervix uteri together in 58 cases. Expressed in percentage, the extra-genital chancroids are only 6.05 per cent. of the total number of chancroids recorded, while of these none are cephalic (that is, occurring upon the head and face).

LOCALITIES OF SIMPLE VENEREAL ULCER AND OF INITIAL LESION OF SYPHILIS.

Table XV.

(Ricord, op. cit., p. 364.)

	Indurated chancre.	Simple chancre.
Patients affected with chancres of the glans and prepuce	314	296
" " " " of the fossa glandis	60	15
" " " multiple chancres of the penis, that is, seated upon the prepuce and the fossa, the fossa and the glans, etc.	11	17
" " " multiple chancres of the meatus urinarius	32	9
" " " intra-urethral chancre	17	3
" " " chancres of the scrotum	7	0
" " " " of the peno-scrotal angle	4	0
" " " " of the anus	6	2
" " " " of the lips	12	0
" " " " of the tongue	3	0
" " " " of the nose	1	0
" " " " of the nasal mucous membrane	1	0
" " " " of the eyelid	1	0
" " " " of the fingers	1	1
" " " " of the leg	1	0
	471	343

Table XVI.

(Fournier, op. cit., p. 72.)

	Simple chancres.
Chancres of the glans and prepuce	347
" " fossa glandis	21
" " penis, that is, occupying at the same time the prepuce and the furrow, or the furrow and the glans	24
" " penis, no more precise designation	25
" " meatus urinarius	11
" " urethra	5
" " scrotum	3
" " pubes	3
" " internal and upper aspect of the thighs	2
" " anus	1
" " fingers	2
" " anterior thoracic region	1
	445

Table XVII.

(Debauge, op. cit., pp. 62–63.)

Simple chancres.

Chancres of the fourchette, or of the fossa navicularis			.	.	.	.	.	.	.	78
" " " or of the labi majora			.	.	.	.	.	.	.	19
" " " " " minora			.	.	.	.	.	.	.	16
" " meatus urinarius (19 of these invaded the urethra)								.	.	1
" " vicinity of the meatus			.	.	.	.	.	.	.	2
" " vestibule .			.	.	.	.	.	.	.	4
" " clitoris .			.	.	.	.	.	.	.	1
" " introitus vaginæ st outside of the carunculæ myrtiformes, between these and the labia minora					.	.	.	.	.	17
" " vagina posterior to carunculæ .			.	.	.	.	.	.	7
" " cervix uteri .			.	.	.	.	.	.	.	1
" " margin of anus			.	.	.	.	.	.	.	23
" " intercrural angle			.	.	.	.	.	.	.	5
" " perineum			.	.	.	.	.	.	.	5
" " internal aspect of thighs .			.	.	.	.	.	.	5
" " hypogastrium .			.	.	.	.	.	.	.	2

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Table XVIII.
(Males.)

(Sturgis, Records of Third Venereal Division, Charity Hospital, Blackwell's Island,
New York, 1879–80.)

Simple chancres.

Chancres of the prepuce .			.	.	.	.	.	.	.	45
" " " and glans penis .			.	.	.	.	.	.	14
" " penis (so stated in records)			.	.	.	.	.	.	5
" " meatus .			.	.	.	.	.	.	.	2
" " sheath of penis			.	.	.	.	.	.	.	5
" " glans penis only .			.	.	.	.	.	.	7
" " frænum .			.	.	.	.	.	.	.	5
" " neighborhood of the meatus .			.	.	.	.	.	2
" " meatus extending into the urethra .			.	.	.	.	1
" " inner aspect of thigh			.	.	.	.	.	.	3
" " nates .			.	.	.	.	.	.	.	1
" " scrotum .			.	.	.	.	.	.	.	6

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Table XIX.
(Females.)

(Sturgis, Records of Third Venereal Division Charity Hospital, Blackwell's Island,
New York, 1879–80.)

Simple chancres.

Chancres of the labia majora .			.	.	.	.	.	.	.	22
" " " minora .			.	.	.	.	.	.	.	17
" " vulva, so stated in records			.	.	.	.	.	.	5
" " anus .			.	.	.	.	.	.	.	8
" " neighborhood of the meatus .			.	.	.	.	.	1
" " vagina inside of ostium vaginæ			.	.	.	.	.	9
" " vagina outside of ostium vaginæ			.	.	.	.	.	7
" " perineum .			.	.	.	.	.	.	.	2
" " fourchette			.	.	.	.	.	.	.	12

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Table XX.

(Sims Perondi, quoted by and taken from Debauge, op. cit., p. 63.)

Simple chancres.

Chancres of the fourchette and cervix uteri			.	.	.	.	.	.	58
" " " alone .			.	.	.	.	.	.	8
" " meatus urinarius .			.	.	.	.	.	.	2
" " anus .			.	.	.	.	.	.	.	2
" " vagina .			.	.	.	.	.	.	.	28

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Résumé.

(1) Total number of chancroids recorded 1271
      "   "   seated on genitals 1194
      "   "   extra-genital 77
      Of these latter none were found upon the head and face.
(2) Total number of initial lesions recorded 471
      "   "   seated on genitals 434
      "   "   extra-genital 37

Percentage of genital chancroids to total number 93.95
      "   extra-genital chancroids to total number 6.05
      "   cephalic chancroids to extra-genital 0.00
      "   genital initial lesions to total number 92.20
      "   extra-genital initial lesions to total number 7.80
      "   cephalic initial lesions to extra-genital . . . . .54.

On turning to the initial lesions, although we find the percentage of the extra-genital ulcers to be only slightly in excess of that of the chancroids (7.8 per cent. as compared with 6.05 per cent.), the percentage of cephalic to extra-genital lesions is very large, 54 per cent. Still, although I have been unable in my statistics to come across any cases of cephalic chancroid, it would be unwise to conclude that they never occur, as several such have been reported. I do not here mean to include cases in which artificial inoculation of chancroidal matter has been successfully performed in the cephalic region; the only examples which I shall now consider are those which have been observed clinically.

The first positive case of the kind which I know of, is one given by Ricord,[1] with a plate, the history of which is a curious commentary upon the quotation on page 424, taken from his "Leçons." It is quite short, and I give it here in full:—

"Primary and non-indurated ulceration of the upper gum. Here is a virulent and primary ulcer of the gum, contracted by the application of the mouth to the genital organs of a woman affected with chancre.

"It is the only example that we have met with, which proves that chancres of the gums are much more rare than virulent ulcerations of the lips and of the tongue, which we have had occasion to observe several times.

"This ulceration, of which the duration has not been very long, followed the ordinary course of the non-indurated chancre. It healed up under the influence of frequently repeated cauterizations with the nitrate of silver and of lotions of aromatic wine.

"Our object in calling attention to this case is to prove that the virulent, inoculable syphilitic pus has not, as its seat of predilection, any particular organ, but that it acts always at first locally, wherever it meets with the conditions favorable for its development. Moreover, the fact that in this patient there has been no constitutional infection, as we were able to determine long after the period at which it ought to have developed itself, proves that the gravity of syphilis does not depend, as has been said, upon the seat of the primary lesion."

It should be remembered that, at this period of Ricord's teaching, he had not yet distinguished between the chancroid and the initial lesion of syphilis, and that hence, in speaking of this lesion being syphilitic, he was in error, as he subsequently acknowledged. Although no auto-inoculation was practised, the history of the case and the appearance of the lesion in the plate leave no reasonable ground for doubting that the case was one of chancroid of the gum. Still, Ricord is unwilling to admit that it was such a lesion, for he says, on the fifteenth page of his "Leçons sur le Chancre" (Paris, 1860):—

"These chancres (cephalic) always belong, and I might say inevitably, to but one species, the indurated. They are always accompanied by the symptoms of constitutional

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[1] Clinique Iconographique, etc., pl. 21.

syphilis. Not one of them is exempt from induration, not one of them is confined to a local lesion without reaction upon the entire system, nor without phenomena of general infection. I shall not speak here of a case which I have published elsewhere. This case, which relates to a non-indurated chancre of the gum, would appear as a most conclusive exception, were it not for the fact that I have become more exacting in drawing conclusions than I was when I published the case. I repeat, that this case referred to a non-indurated chancre of the gum, which was not followed at the proper time by constitutional symptoms, and this chancre was derived from a woman who also had a chancre; but I ought to add that I did not see the woman, and that a knowledge of her disease was derived from the patient. I should also state that no artificial auto-inoculation was performed, hence the correctness of the diagnosis and the value of the case may very properly be doubted."[1]

Fournier[2] gives the following case from Puche:—

A young man applied to Puche on the 17th of November, 1861, with an ulcer of the lower lip near the median line, which was chancrous in appearance, and had lasted three or four days. This ulcer came eight days after a connection, "the nature of which," as Puche says, "the patient did not attempt to deny." There was a slight adenitis of the submental gland. The patient was taken to Cullerier for an opinion, which was "indurated chancre." Puche, dissatisfied apparently with this diagnosis, practised auto-inoculation with the secretion of the ulcer on the man's abdomen. While the inoculation was being made, the patient, attempting to restrain the surgeon's hand, pricked himself on the finger with the instrument. The result in both places was positive in a few days. Local treatment was now instituted, and all three ulcers healed without induration, and the patient passed from observation on the 31st of December, 1861, without any constitutional symptoms of syphilis.

The history of this case it would be hard to controvert, and unless we are prepared to entirely abandon the value of auto-inoculation in diagnosis, we must be willing to admit that this was an undoubted case of chancroid of the lip. I know that the experiments that have been made with simple pus would seem to rob this case of many of its distinctive features in a diagnostic point of view, but when we consider that these ulcers have been artificially inoculated upon the face by many trustworthy observers, it would, I think, be a refinement of criticism to deny that this case was one of true chancroid of the lip.

Diday[3] gives two separate cases of what he calls "chancrelles de la bouche," and MM. Boys de Loury and Costilles[4] give two more cases, one of the eyelid and one of the ear, but these cases are so imperfect as to be worthless, and I shall make no further mention of them.

Millet, in his thesis, gives a curious though somewhat imperfect account of a man who on the 12th of July, 1865, went bathing in a forbidden locality, was chased by the police, and was in the water for two hours. When he came out he was very much exhausted and had violent lumbar pains. On the 13th, he went to the Hôpital St. Antoine, where he was confined to bed for fourteen days, during which time he saw no outside friend but his mistress. On the 28th, the day after leaving the hospital, he noticed a smarting of the lower lip, on the skin and mucous membrane of which were some small yellow pimples. The next day these pimples were covered over with a crust. Thinking he had some venereal affection, although he declared that his mistress was perfectly healthy, he went to the Hôpital du Midi on the first day of August.

[1] Ricord, in his "Traité pratique des Maladies Vénériennes," published in 1838, gave in his tables of inoculations seven cases of primary syphilis on the lips, and three in the throat, all of which produced the characteristic pustule of inoculation, as among the cases which occurred in his wards in 1831 and 1837. As no details are given, the cases are worthless in a scientific point of view.

[2] Nouveau Dictionnaire de Médecine et de Chirurgie Pratiques. Art. Chancre.

[3] L'Union Médicale, 1858; and Annales de Dermatologie et Syphiligraphie, 1872, No. 2.

[4] Gazette Médicale de Paris, 1845, 1847.

On his entrance the following condition of things was observed. Smarting of the lower lip which was found swollen, patulous, and devoid of induration. The mucous membrane was deep red in color, and glistening. On the mucous surface of the lower lip, near the gingivo-labial fold, was a chancrous-looking ulceration, and on the cutaneous surface covered by the beard, were two small ulcers covered with crusts. His teeth were good, but dirty and uncared for. (He was a great smoker.) The mouth and pharynx were sound. A submaxillary lymphatic gland, in the median line, was enlarged to the size of a pigeon's egg, and painful on pressure. Abundant salivation was present, but the breath was not fetid. There was no pain in the lip except on mastication. The last coitus, according to his statement, had taken place on the 10th of July. On the 2d of August, inoculation was made with matter taken from the ulcer on the inside of the lip, and this inoculation was positive in result. The resulting sore lasted for fifteen days, and disappeared without treatment, while the ulcers of the lip healed under the local use of chlorate of potassium. The submaxillary ganglion did not suppurate.

Millet himself seems to doubt whether this lesion was really a chancroid, and he says that its value is impaired by two circumstances: the first is that he did not have permission to examine or even question the man's mistress; and the second, that the pus of ulcerative stomatitis has been proved autoinoculable in several instances by M. Bergeron, of the Hôpital Sainte Eugénie.[1]

The next case is one reported by Labarthe.[2]

It occurred in a man who applied for treatment on the 4th of December, 1870, with three chancroids of the penis and a right inguinal adenitis attended with fluctuation. The bubo was opened on the same day, and local treatment was pursued for both sets of lesions. On the 8th of December, the patient called the doctor's attention to his lower lip, which pained him. There, at a point midway between the median line and the left commissure, was a longitudinal ulceration which had the appearance of a deep fissure. The edges, however, were punched out and a little undermined; the floor was grayish in appearance, and furnished a purulent secretion. Upon questioning the man, it appeared that he was in the habit of placing the pin which confined the dressing of his bubo between his lips. Labarthe believed that he had to do with a chancroid of the lip, but to make assurance double-sure, he inoculated the matter from the ulcer on the man's lip, above his abdomen, and in four days the result was positive.

The next cases are those of Profeta, of Palermo, which are translated from the Italian in the fifth volume of the Annales de Dermatologie et de Syphiligraphie.

The *first* case was that of an Italian musician, whose chancroid, of two years' duration, began at the right commissure of the lips, and extended over the cheek and forehead. It was phagedænic in nature, and was seated upon an engorged but not indurated base; it secreted an abundant purulent matter; its edges were livid and undermined; in short, it presented all the aspects of a phagedænic chancroid. No evidences of constitutional syphilis were present, but the patient had a vesiculo-pustular eruption due to the presence of the *acarus scabiei*. Auto-inoculation was practised with the pus of this ulcer, with a positive result.

The *second* case was one of a barber who had multiple chancroids of the penis, with a suppurating bubo. Attempting to open this bubo with a razor, he cut his finger, soiling the wound with pus and blood from the bubo. He then promptly put his finger in his mouth to stanch the bleeding, and the following condition of things ensued. He had a chancroid of the index finger of the left hand, with lymphatic engorgement of the arm of the same side; besides this, he had two chancroidal ulcerations of the upper and lower lips, which invaded both the skin and mucous tissues of these parts. He apparently declined treatment, but Profeta saw him from time to time for a year, and states that his face was peppered (parsemé) with chancroids.

[1] De la Stomatite ulcéreuse. Paris, 1860. [2] Le Chancre simple, Thèse, p. 53.

The *third* case was one of phagedænic chancroid of the penis, this latter being almost entirely destroyed by the ulceration. There were also a chancroid of the scrotum, and an ulceration seated upon the right ala nasi which bore all the characteristics of a chancroid. This latter chancroid inoculated the tissues about the nose, and finally became phagedænic and produced great destruction of those parts. Although this ulcer improved under treatment, the patient disappeared from Profeta's sight before cicatrization was complete.

In this third case, auto-inoculation was not resorted to, and hence doubt might arise whether this were not an ulcerating serpiginous syphilide of the face and of the body, although no history of syphilis is given; but with the first two cases, I think no reasonable doubt can exist, if we concede the existence of such a thing as a chancroid.

Profeta's fourth case is reported in the Gazette Médicale de Lyon, for 1867, and was a serpiginous chancroid of two years' duration, which was seated upon the face. Profeta inoculated himself with the pus of the chancroid in five places, producing five chancroids which were not, in the space of eighteen months, followed by constitutional syphilis.

Dr. R. W. Taylor,[1] of New York, reports a case which occurred in his own practice at the New York Dispensary.

A man with chancroids of the prepuce inoculated himself over the outer margin of the left supra-orbital ridge with the pus from his chancroids, producing an ulceration which had all the appearances of a chancroid. Matter from this supra-orbital ulcer was inoculated upon the man's abdomen, care being taken to prevent contamination with the matter from the chancroids of the penis, and in four days afterwards a positive result was obtained.

Apart from these cases of accidental inoculation, artificial inoculations have been resorted to by Bassereau, Puche, Rollet, Hubbenet, and others, which conclusively prove the possibility of inoculating chancroidal pus upon the face. It has been stated that one peculiarity of cephalic chancroids is that they are short-lived, but upon reviewing the cases on record this point is not to my mind satisfactorily proved. Enough cases have been reported to show that the cephalic region is not exempt from being the possible seat of a chancroid. Such ulcerations are, it is true, not common in this region, and hence we may lay down the general law that ulcerations of this portion of the body should be regarded with suspicion, and should be considered as syphilitic, unless the contrary can be distinctly proved.

ORIGIN OF THE SIMPLE VENEREAL ULCER.

As already stated, Clerc, in 1854, considered that the chancroid was the result of inoculation of the matter of an indurated chancre upon a person who either was suffering or had suffered from constitutional syphilis. Since Clerc's time, however, this doctrine has fallen somewhat into discredit, and until within a short period it has generally been believed that the chancroid and the chancre were produced by two distinct kinds of virus, and that it was not possible to produce a chancroid by any other means than by contact of a chancroid or a chancroidal bubo. Here is another instance of the error produced by this word " *virus*," a term which I trust will be expunged in time from the venereal vocabulary. We have already seen that it is possible to produce a sore corresponding in many points with a chancroid from the inoculation of simple pus, and if these experiments be trustworthy, then it is the pus-corpuscle which is the cause of the ulcer (chancroid), and not any suppositious

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[1] Archives of Practical Medicine, 1873.

virus. Let us see if the same thing can be done with the secretion of syphilis, and under what conditions success is obtained.

In 1854, M. Maratray (de Nevers) published a case[1] which is very interesting and instructive.

" During September, 1852, one of my friends, who was syphilitic at the time, consulted me as to the nature of an ulceration situated upon the frænum, dependent, so he said, upon a coitus dating twelve days back. At a glance I recognized a specific ulceration with a tendency to become phagedenic. He informed me that another young man who upon the same day had had connection with the same woman, was suffering with a less painful and less extensive ulceration. Upon examination of this young man, I recognized upon him an indurated chancre accompanied with a perfectly well characterized inguinal adenitis, one of the most certain signs of constitutional infection. I asked if it were possible to see the presumed cause of the trouble. Frightened by the word " *pox*," she consented to an examination. My attention was attracted at first to the fourchette, the seat by predilection of chancres in the woman, and this the more on account of the strange coincidence of the ulcer of the frænum in the man. I at once discovered a specific ulceration in process of repair ; palpation showed a hard, cartilaginous, elastic nodule, which by compression blanched the neighboring tissues. All the characteristics of the indurated chancre were present ; there was no possibility of mistake ; the inguinal ganglia, although somewhat difficult to recognize, were yet perceptible by comparison with those of the unaffected side. In spite of great care, further research failed to reveal in any portion of this woman's genitals, whether in the vagina or the neck of the uterus, any reason for the existence of the phagedænic chancre. As the good hygienic conditions under which the first patient was placed compensated somewhat for the debilitating influence of the syphilis, a local dressing of aromatic wine led to a pretty prompt cure. As to the two indurated chancres, as already stated, cicatrization had commenced, and went on to completion. I learnt subsequently that secondary symptoms appeared in the man and in the woman notwithstanding a mercurial treatment of some duration."

This case was followed, in 1856, by the two following, mentioned by Ricord and quoted by Fournier.[2]

Case I.—One of my old patients, whom I had treated several months during my service in 1843 for an indurated chancre, followed by constitutional manifestations—roseola, mucous patches of the mouth, posterior cervical adenitis, alopecia, etc.—had connection with a woman of the town during May, 1856. It was at least two months before this time since the patient had seen another woman. Some days after this connection, two chancres appeared upon the prepuce, one upon the cutaneous, the other upon the mucous, surface. The patient at first pursued no treatment. When I examined him, the chancres were of ten days' duration, the size of a ten-cent piece, without any induration of the base—indeed, they were quite supple and exempt from inflammation. The glands of the left groin were slightly swollen and painful. The diagnosis was beyond question. I had to deal with simple chancres, at least as far as their external characters were concerned. They healed up, without complications, under simple dressings of aromatic wine. The adenitis rapidly disappeared. No internal treatment was used, but the patient, kept under careful observation, has not presented any new symptom of syphilis. While this patient was being treated at the *Midi*, my *interne* looked up and found the woman who was pointed out as the source of the man's disease. What do you suppose was found ? A typical indurated chancre of the labium majus, with an enormous chondroid induration. This chancre, according to the patient, had existed for several weeks. It was accompanied by a well-marked adenitis, and was followed by subsequent constitutional manifestations.

Case II.—L., a girl seventeen years of age, was infected in June, 1856, with an indurated chancre, accompanied by an inguinal adenitis, in which the glands were multiple, hard, and indolent. She followed a mercurial treatment for only a few weeks' time. In September, a confluent roseola covered her body, the hair began to come out, and a double cervical adenitis showed itself. There could be no question as to the dis-

[1] Op. cit., p. 49 *et seq.*   [2] Recherches sur la Contagion du Chancre.

ease in this case. During the last of June, one of my former patients, whom I had treated in 1842 for an infecting chancre followed by constitutional symptoms, had connection with this girl, and contracted two chancres on the penis, one at the frænum, the other on the prepuce. These two chancres were entirely devoid of induration; their bases remained supple. The inguinal ganglia were not affected, and, although no specific treatment was employed, constitutional manifestations did not appear.

Ricord considered both these cases as simple chancres (that is, chancroids), produced by the secretion of an indurated chancre (initial lesion of syphilis) upon a person previously syphilitic. But another explanation of these two cases may be given. A double infection (what Rollet called a mixed sore) may have existed in the woman; she may have had both a chancroid and syphilis at the same time. Each following the laws of its existence, the chancroid would appear first. The men, having coitus at that time—and there is nothing in the histories to disprove this supposition—before the syphilis made its appearance, would naturally contract only a chancroid; the woman, seen when her chancroid had gone, and when the initial lesion had appeared upon the scene, would be unquestionably syphilitic; and the deduction being drawn that the secretion of the initial lesion had produced a chancroid, error and confusion would follow.

Let us see if any other cases have been reported which will assist us in our search.

H. Rey[1] reports a most extraordinary case, which is briefly as follows:—

Two young men, A. and B., free from any previous syphilis, have connection on the same day with the same woman, C. From ten to fifteen days (sic) after, A. calls upon M. Rey, and shows him an indurated chancre with inguinal adenitis. A few days subsequently B. calls upon M. Rey, and shows him four chancroids of the penis, with an inflammatory mono-glandular adenitis. C. is then examined. She has an indurated chancre at the fourchette, with double syphilitic adenitis. The sequel in the three persons is, that A. has cervical adenitis and mucous patches in the throat; B. has a suppurating bubo, this and the chancroid finally heal under local remedies only, and no constitutional manifestations appear within six and a half months after cicatrization of the chancroid; C. has a macular syphilide.

What shall be said of this case of M. Rey? Let us run over the points: Two men, A. and B., entirely free from syphilis, cohabit on the same day with the same woman, C. She has "*un chancre induré magnifique.*" What is the result? One, A., contracts syphilis—just what we should expect; but the other, B., contracts chancroids—what we should not expect. Why? Inexplicable, unless this happened: B. followed A. directly in coitus; the excitement and stimulation of A.'s coitus caused the woman's initial lesion to suppurate, and the pus thus produced was inflammatory and capable of inoculation, not as syphilis, but as a local ulcer (chancroid). This is pure hypothesis, because, although we have the records of many cases of auto-inoculation of *irritated* initial lesions, there are none, as far as I know, of inoculations with such matter of irritation on subjects free from syphilis, and until this is done the problem must go unsolved.[2]

But though we have not any cases exactly corresponding to the conditions above named, there is one, published by Robert,[3] which presents us with a very interesting experiment indirectly bearing upon this subject:—

Madame J. was affected with two cancerous ulcerations of the nose, the largest of which was the size of a franc piece (quarter dollar).

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[1] Annuaire de la Syphilis, 1858.
[2] In this connection, consult Lee, Lectures on Syphilitic and Vaccino-Syphilitic Inoculations. London, 1863; Boeck, Recherches sur la Syphilis. Christiania, 1862; Danielssen, Deutsche Klinik, No. 33, 1858, etc.
[3] Nouveau Traité des Maladies Vénériennes. Paris, 1861. This case has been given more fully on page 411, to establish another point.

October 14. The more extensive ulceration was dressed with a dossil of lint soaked in the pus taken from a recent chancre of inoculation practised upon a syphilitic patient; this chancre was derived from a simple ulceration.

October 16–25. The peripheric inflammation has increased; the ulceration has extended. The floor of the ulcer is gray; its scalloped borders are undermined. Suppuration is very abundant, and the patient complains of a decided heat and tingling in the part. No glandular enlargement.

November 1. Ulcer is evidently transformed into a chancre.

December 15. The wound which was inoculated and partially cicatrized was dressed with aromatic wine. No signs of adenitis and no signs of infection.

December 27. The ulcer of inoculation, as well as the second cancerous ulceration, had both entirely healed. There was no sign of any constitutional infection. The dressings had been diachylon at first, and afterwards aromatic wine.

So far, then, no cases have been published, or are known, which prove the direct descent of the chancroid from syphilis, as those which I have presented (the only cases I can find upon this branch of the subject) are all open to serious question.

Of course, it would be idle to speculate upon the possibility of future experiment proving this derivation, so that we must at present content ourselves with saying that *the simple venereal ulcer (chancroid) is derived from the secretion of another chancroid, or of a virulent (chancroidal) bubo, and from nothing else.* Nor does the possibility of simple pus being auto-inoculable deprive this fact of any of its importance.

ANATOMY OF THE SIMPLE VENEREAL ULCER.

But little has been written upon this subject, and most of our knowledge of the pathology of the chancroid is derived from the works of German

Fig. 327.

Section made through a soft chancre [chancroid]. Hartnack, oc. 3, obj. 4. (Kaposi.)
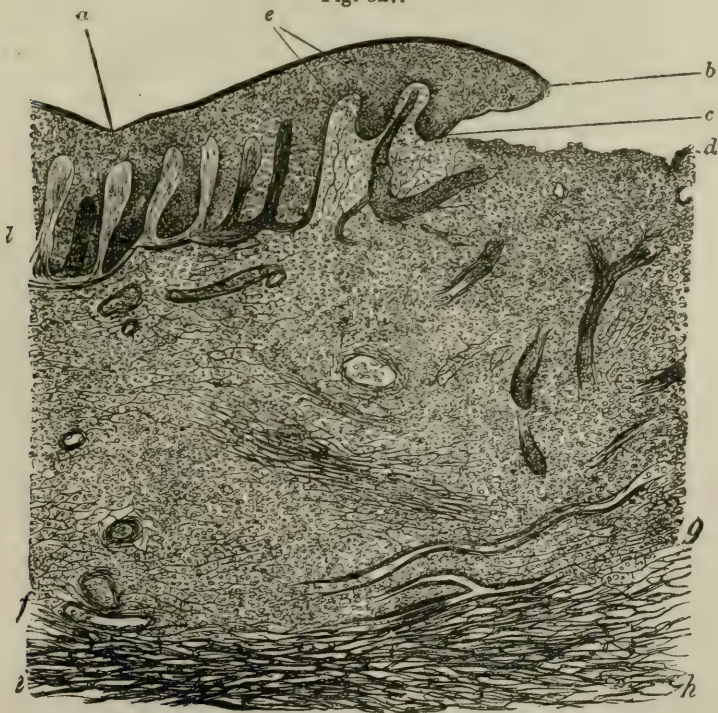
observers. Kaposi[1] and Caspary[2] are the most recent writers upon this subject, and as Kaposi's description is the best, I shall give it in full :–

Microscopical examination of a perpendicular section, including the margin, the inflamed parts in the neighborhood, together with a portion of the floor and the inflamed base of the ulcer, shows that a portion of the skin occupied by the chancroid consists of two parts, which have evidently undergone different anatomical changes. (Fig. 327.)

From the floor of the ulcer, c d, to a considerable depth in the corium is a uniform and uncommonly thick cell infiltration which terminates sharply at the line f g. This infiltration is continued beneath the intact papillæ of the margin of the ulcer, e l, and laterally far beyond the limits of its floor. The tissue bordering on the infiltrated

Fig. 328.
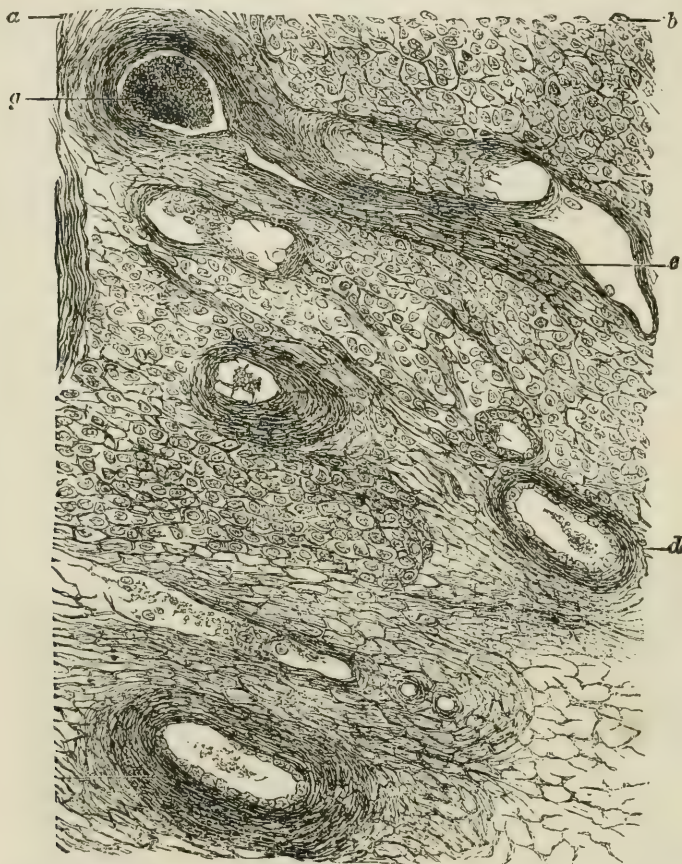
Section made through a soft chancre [chancroid]. Hartnack, oc. 3, obj. 7. (Kaposi.)

mass, f g h i, is composed of loose meshes, and exhibits scattered cells with a large nucleus, which is well brought out by carmine. In the swollen margin, a b, a number of papillæ, e, lying nearest to the floor of the ulcer are thickened and closely infiltrated with cells. The layer of Malpighian cells between these papillæ is thickened. These, b, overhang (undermining) the walls of the ulcer. The floor of the ulcer, c d, is formed by the exposed cell-infiltrated corium and is destitute of papillæ. Both the corium and

[1] Syphilis der Haut und der angrenzenden Schleimhäute. Wien, 1873.
[2] Zur Anatomie des Ulcus durum und molle. Vierteljahrsschrift für Dermatologie und Syphilis, 1876.

papillæ, wherever infiltrated with cells, exhibit numerous enlarged vessels, most of which are bloodvessels. A few, however, are lymphatics.

With a higher power (Fig. 328), the cell-infiltrated portion, *a b d*, consists of a close network of partly narrow, and partly broad bundles of fibres with faint contours, in which is deposited an abundance of nucleated and evenly distributed cells, some of them very large and resembling lymph corpuscles, others smaller. The cells lying near the floor of the ulcer and the neighboring parts are for the most part small and irregular in outline, with scattered nuclei. Free nuclei and nucleoli are also found in large numbers. In the deeper tissues, the cells have generally the appearance of inflammation-corpuscles, but there are also many smaller ones. Of great interest is the remarkable thickening of the walls of the vessels, *e d g*, which appear to be embedded in an abundant network of tissue-proliferation, due to adventitious fibrous deposits running parallel to them. In this network, cells with large nuclei are found. The openings of the vessels are everywhere apparent throughout this cell-infiltrated tissue, inasmuch as they are kept dilated by the surrounding œdema. The degeneration of the tissues and of the infiltrated cells takes place only in the upper portion, and to an extent which is only limited by the extent and depth of the infiltration. Interstitial abscesses do not exist. We have not found any characteristics which would enable us to distinguish the cell-infiltration of the corium and the papillæ, or the subsequent degeneration of the same, from similar processes of simple origin.

COMPLICATIONS OF THE SIMPLE VENEREAL ULCER.

The complications which occur with this variety of ulcer are numerous, and the acuter the inflammation the more likely are they to occur.

BUBO.—That most frequently met with is the bubo, and this is of two kinds, the "*simple*," which is sympathetic in nature, and is really nothing but a glandular or peri-glandular abscess, which secretes healthy pus and heals up rapidly as soon as its contents are evacuated; the other the "*virulent*," which is always serious, depending upon the absorption of the chancroidal matter by the lymphatics, and its arrest and retention in the nearest chain of glands, there to produce an inflammatory and contagious ulceration of the gland similar to that which gave rise to the bubo.

As showing the relative frequency with which various complications occur in cases of simple venereal ulcer, I refer the reader to the annexed table, in which will be found the figures bearing upon this subject. In 200 cases

FREQUENCY OF COMPLICATIONS IN SIMPLE VENEREAL ULCERS.

Table XXI.

(Sturgis, Records of N. Y. Dispensary for the last four months of 1879, Division F.)

Patients with chancroids recorded	200
" without complications	135
" with "	65
buboes (non-suppurating)	22
phimosis	21
gonorrhœa	17
balano-posthitis	5

taken from the records of the New York Dispensary for the last four months of 1879, it will be seen that complications occurred in 65, or in about one-third of the cases, and that of these 65 patients who presented complications, 22, or nearly one-third, suffered from buboes, while phimosis, gonorrhœa, and balano-posthitis made up the remaining two-thirds. The bubo then we may accept as the most frequent complication found with chancroids, and the next question for consideration is whether buboes are usually mono-lateral or

bi-lateral. On looking at the first of the appended tables, we observe that 71 patients were the bearers of buboes, 54 having but a single bubo, while 17 had bubo on both sides; this is accounted for by the fact that the bubo is generally mono-lateral unless the ulcer is seated upon, or close to, the frænum of the penis, when both groins are attacked, and that chancroids of the frænum are not as often met with as chancroids of other portions of the genital mucous membrane. (See Table XVIII. page 426.)

FREQUENCY OF BUBO IN CASES OF SIMPLE VENEREAL ULCER.

Table XXII.

(Sturgis, Records of Third Venereal Division Charity Hospital, B. I., N. Y., 1879–80.)

Patients affected with simple venereal ulcers	249
Without bubo	178
With buboes	71
Of these—with single bubo	54
with double buboes	17

Table XXIII.

(Ricord, op. cit., p. 40.)

Patients affected with simple chancres	207
" " " buboes	65
" without buboes	142

Table XXIV.

(Sturgis, Records Third Venereal Division, Charity Hospital, B. I., N. Y., 1879–80.)

Total number of buboes	71
Suppurating buboes	30
Non-suppurating buboes	41

Résumé.

Total number of patients recorded	456
" " with buboes	136
" " without buboes	320
Percentage of patients with buboes to total number, almost	30
Total number of buboes (see Table XXIV.)	71
Percentage of suppurating buboes to total number of buboes (Table XXIV.)	.42.2

As regards the pathology of this kind of bubo, it may be repeated that there are two kinds, viz., the sympathetic bubo, and that resulting from absorption. The first symptom noted by the patient is a feeling of pain and uneasiness in one or both groins, aggravated by motion, and upon examination the surgeon readily detects a swollen and painful gland or glands. This enlargement differs materially from the adenitis found in syphilis, in that the gland is not felt distinct and separate from the surrounding tissues, but is sunk into and matted together with the material of inflammation, infiltration and cell exudation; that the outlines are indistinct; and that the swelling interferes with motion. At first, redness is absent, but in a short time this symptom supervenes, and invades the entire swelling. After lasting a longer or shorter time, a point of softening declares itself at the apex of the swelling, and fluctuation is apparent on palpation. Up to this point, both kinds of bubo run the same course, and there is no means of deciding to which class the swelling belongs. As soon as fluctuation is certain, the wisest course is to open the bubo, and for these reasons: it is a good, fundamental rule in surgery to evacuate pus wherever practicable; the bubo, if simple, heals more rapidly if it be opened, while if it is "virulent," it becomes of decided importance to open it—in the first place, to prevent burrowing, and in the next, to check the destructive action which is always present in these

lesions, and which constitutes a very dangerous element. These buboes, when left to themselves, always sooner or later slough, but sometimes not until they have undermined the skin to an alarming extent; hence it is good surgery under any circumstances to open a bubo in which fluctuation is evident.

The bubo after it is opened diverges widely in its future course according to its nature. The *simple bubo* reveals itself as an ordinary abscess with a clean, healthy-looking floor and edges; it secretes laudable pus, the granulations are red, and bleed easily upon handling, and the wound heals rapidly. The *bubo by absorption*, on the other hand, presents the appearance of a chancroid, which, indeed, it is; the floor is uneven, irregular, unhealthy-looking, covered with a dirty-grayish or yellow pultaceous layer, which is adherent to the ulcer; the edges are undermined for some little distance from the edge of the ulcer, and the overlying skin is dead and shrivelled; the discharge, which is copious, is grayish or brown, sanious, and irritating, differing widely from healthy pus, and healthy granulations are absent. Unless checked by proper treatment the ulceration extends rapidly, destroying tissue and burrowing deeply in the groin, down the thighs, and even up the abdominal walls, not infrequently giving rise to alarming hemorrhage from erosion of the superficial epigastric and femoral arteries.

The other complications liable to occur with the simple venereal ulcer are Phimosis, Paraphimosis, Balanitis, and Phagedæna.

PHIMOSIS AND PARAPHIMOSIS.—These complications are only serious if aggravated by intense inflammation, when they produce gangrene from impediment to the proper nutrition of the part. In *phimosis* the skin of the penis becomes enormously œdematous, the prepuce cannot be retracted, and the discharge from beneath the foreskin becomes often so abundant as to give rise to doubt whether the case may not be one of gonorrhœa instead of chancroid. Auto-inoculation here comes to our rescue, and if the experiment be successful, all doubt will be ended as to whether the surgeon has a gonorrhœa or a chancroid to deal with, for the secretion of gonorrhœa is incapable of auto-inoculation. If, on the other hand, the experiment is unsuccessful, the probabilities will be in favor of the concealed disease being simply a clap, and this point is of importance in regard to treatment, inasmuch as in the latter event incisions may be resorted to for the relief of the phimosis, which the surgeon would hesitate to use if the concealed disease were chancroidal.

In *paraphimosis* the diagnosis is much easier, as the parts are more exposed to view, and the only question to occupy the surgeon is the prevention of gangrene.

BALANITIS is not an infrequent concomitant of chancroids, and is more annoying than serious, the abrasions becoming converted into chancroidal ulcers, which have a tendency to run together into one large sore.

PHAGEDÆNA.—Besides the complications hitherto considered there is one other, by far the most serious which can befall. I mean *Phagedæna*. This occurs in consequence of some constitutional defect, such as Tuberculosis or Scrofula, or from a vitiated condition of the system—as, for example, alcoholismus—and not from any inherent vice in the ulcer, or in the inflammation attendant upon the chancroid itself. When this is attacked by phagedæna, a notable change occurs in its character and local aspect. The pus, which formerly was abundant and fairly purulent, now becomes scanty and thin; its color changes from yellow to brown, sometimes even to black, from the detritus of tissue; the floor of the ulcer becomes of a leaden-gray, brown, or black

hue, and is converted into a thick, grumous, pultaceous mass ; the undermined edges of the sore collapse, while simultaneously fresh burrowing goes on, extending the area of the wound to an alarming extent.   Sometimes an attempt at cicatrization takes place at one end of the ulcer, while rapid progress is being made at the other ; and when this assumes a sinuous course the affection is known by the name of the "*Serpiginous Phagedænic Chancroid.*" At other times, the floor of the ulcer is overspread with a grayish flocculent membrane, not unlike the diphtheritic membrane, which is closely adherent to the sore.   This goes by the name of the "*Diphtheritic Chancroid.*"   The odor emanating from such ulcers is sickening, and the patient, exhausted by this constant suppuration and necrosis of tissue, assisted sometimes by hemorrhage as bloodvessels are eroded by ulcerative action, is often reduced to an alarming condition of debility.

Under appropriate treatment the phagedæna sometimes disappears, when the ulcer assumes the appearance of a simple granulating wound, and finally heals, but often at the expense of serious loss of tissue, leaving as a reminder of its presence an indelible scar.   But this happy result is not always attained, for sometimes the ulcer obstinately refuses to heal under the most approved treatment, and remains in an indolent, unhealthy condition, the floor being covered with a grayish exudation, and the few granulations that spring up being flabby and easily destroyed.   In this condition the ulcer will sometimes remain for a longer or shorter time, until excited into action by some accidental cause, when suddenly the activity of the disease will be renewed, the phagedænic ulceration will extend with frightful rapidity, and severe loss of tissue will ensue.   This renewed activity will after a while subside, and the ulcer will then relapse into its former indolent condition, until again excited into activity.   These "*Chronic Chancroids*" are practically incurable, and the patient finally succumbs from exhaustion, and, as I believe is often the case, from an associated phthisis.   I have observed during my hospital experience many such cases, and although I am not yet prepared to say absolutely that phthisis was the cause of incurability of the ulcer, I believe that it played an important part in that direction.

MIXED CHANCRE.—There is another condition of things occurring with the chancroid which can hardly be called a complication, but which is full of interest and worthy of mention.   I allude to the so-called "mixed chancre" of Rollet, the invention of which was a happy stroke of genius to account for certain ulcers which, although undoubtedly chancroidal in the beginning of their career, in due time became converted into initial lesions, and were followed by other symptoms of syphilis.   In consequence of the name, much confusion arose from the belief that a real admixture of the two kinds of virus took place, and that the secretion of this ulcer would by inoculation produce a sore which, although chancroidal at first in all respects, would become syphilitic, and be followed by the subsequent manifestations upon the skin and mucous membranes.   Such, however, has been found by experience not to be invariably the case; and in those instances in which the occurrence did take place, it was due to the period at which the sore whence the matter for inoculation was taken had arrived.

Thus, if the matter was used when the sore was still young, that is, within the first fourteen days of its existence, the inoculated ulcer was and remained throughout a chancroid; if, however, the matter was taken between the fourteenth and the twenty-first days, then the resulting ulcer would often start as a chancroid and end as an initial lesion; but when the matter was not taken until the sore was twenty-one or more days old, then no chancroid would appear, but the resulting inoculation would be from the beginning an initial

lesion. In other words, there was a commingling of two kinds of poison; what did occur was a double infection at the same spot—possibly, not necessarily, at the same coitus—and, each disease following its own natural course, the first to appear would be the chancroid, and after that, at the proper time, the syphilis embodied in the initial lesion. Each disease, to parody the well-known maxim in the old Roman policy, "divide et impera," pursues its own course undisturbed by the other, as far as it is possible to do so, but the syphilis, as the more chronic affection, naturally outlives the chancroid.

DIAGNOSIS OF THE SIMPLE VENEREAL ULCER.

To repeat what was said before when discussing the gross appearances of the chancroid, the diagnosis of this variety of ulcer is based upon the following points:—

(1) An *absence of incubation*. The chancroid appears usually within the first eight days after the infecting coitus, and probably in a large proportion of cases even earlier. (See *Résumé* of Tables XI.–XIV., page 423.)

(2) The property of *auto-inoculation*. This consists in a capacity for reproduction within certain limits from the secretion of the original ulcer. Owing to this property, this variety of sore is more often multiple than single. (See *Résumé* of Tables V.–X., page 421).

(3) The *absence of induration* of the *base*. This point, it is true, has lost some of its significance since the discovery of the fact that the initial lesion of syphilis is occasionally met with devoid of induration. Nevertheless, should this point be doubtful, other symptoms must be appealed to in order to establish the diagnosis. The pseudo-induration of the simple venereal ulcer must also be rated by the same standard.

(4) The *copious purulent secretion*. This is due to the inflammatory and destructive nature of the sore.

(5) The *punched-out* and *undermined edges* of the sore.

(6) The *irregular* and *eroded* appearance of the *floor*.

(7) The *grayish-yellow layer* covering the floor of the ulcer. These three last are all due to or result from inflammation.

RELATIVE FREQUENCY OF SIMPLE VENEREAL ULCER AND INITIAL LESION OF SYPHILIS.

Table XXV.

(Ricord, op. cit., p. 10.)

Total number of patients	.10,000
" affected with simple chancres	. 8,045
" " " infecting chancres	. 1,955

Table XXVI.

(Fournier, ibid., p. 9.)

Total number of patients	. 341
" affected with simple chancres	. 215
" " " infecting chancres	. 126

Table XXVII.

(Chabalier, Historique de la pluralité des Maladies Vénériennes. Thèse. Paris, 1860.)

Total number of patients	. 208
" affected with simple chancres	. 118
" " " infecting chancres	. 90

Table XXVIII.

(Belhomme et Martin, Traité théorique et pratique de la Syphilis et des Maladies Vénériennes, p. 129, 1876.)

Total number of patients 150
" affected with simple chancres 105
" " " infecting chancres 45

Table XXIX.

(Nodet, quoted by and taken from Labarthe, Le Chancre Simple, p. 110.   Thèse.   Paris, 1872.)

Total number of patients 136
" affected with simple chancres 71
" " " infecting chancres 65

Table XXX.

(Millet, op. cit., p. 53.)

Total number of patients 386
" affected with simple chancres 201
" " " infecting chancres 185

Table XXXI.

(Belhomme et Martin, op. cit., p 477.)

Total number of patients 353
" affected with simple chancres 123
" " " infecting chancres 230

Table XXXII.

Total number of patients 131
" affected with simple chancres 77
" " " infecting chancres 54

Table XXXIII.

(Labarthe, op. cit., p. 10.)

Total number of patients 167
" affected with simple chancres 104
" " " infecting chancres 63

Table XXXIV.
Division B.

(Sturgis, Records of the Male Venereal Division B, New York Dispensary, from Sept. 1, 1878, to Sept. 1, 1880.)

Total number of patients 619
" affected with simple chancres 389
" " " infecting chancres 230

Table XXXV.
Division F.

(Sturgis, Records of the Male Venereal Division F, New York Dispensary, from Sept. 1, 1878, to Sept. 1, 1880.)

Total number of patients 786
" affected with simple chancres 640
" " " infecting chancres 146

For the permission to consult the records of their divisions, I am much indebted to the courtesy of the attending surgeons, Dr. Bronson and Dr. Fox.

Résumé.

Total number of patients recorded 13,572
" affected with simple chancres 10,337
" " " infecting chancres 3,235
Percentage of simple chancres to total number, is 76.1
" of infecting chancres to total number, is 23.9

Prognosis of the Simple Venereal Ulcer.

Generally speaking, this may be said to be favorable, the large majority of chancroids healing rapidly without leaving any bad results behind, either in the way of systemic infection (for the disease is purely local, never constitutional), or from serious destruction of tissue.   But to this, as to all rules, there are exceptions, and these usually occur when the chancroid is attacked by phagedæna.   In such a case, the destruction is often frightful, and the incurability of the ulcer, the exhaustion which it induces, and the serious hemorrhages to which it gives rise, not infrequently tend to a fatal termination. Such cases are happily rare, at least among our white population, the fatal cases which I have seen having occurred in the dark-skinned races: indeed, I have often been struck with the peculiarly rebellious and alarming course which venereal diseases, particularly chancroid and syphilis, pursue among the negroes and Chinese.   The same peculiarity I am told exists among the Mexicans, especially in those persons who have an admixture of negro or of Indian blood.

Treatment of the Simple Venereal Ulcer.

Under this heading, I shall first consider the treatment of the uncomplicated chancroid, and shall afterwards take up the various complications.   In the treatment of all chancroids, two indications must be steadily kept in view : the first is to prevent the extension of the ulceration and to relieve the inflammation ; the second, to prevent the conveyance of the matter to adjacent or to distant tissues, and thus to obviate the production of fresh sores.

Now, as to the first point :—to prevent the extension of the ulceration and to relieve the inflammation.   The best method of obtaining this result is the destruction of the ulcerated surface, and especially if it be large and progressive, by some active cauterizing agent which shall so change the nature of the ulcer as to cause it to heal up instead of extending—what in ordinary parlance is known as " destroying the virus."   The best agent for this purpose is the actual cautery, the iron being heated to a white heat, the galvano-cautery, or the Paquelin cautery, either one of which is sufficient to change the character of the sore.   This form of cauterization is best adapted to serpiginous, diphtheritic, and phagedænic sores, where extension is rapid and destruction serious ; for the milder varieties, some less powerful caustic is sufficient.   Of these, chemically pure sulphuric acid takes the lead for the thoroughness with which it destroys the ulceration ; next to this come caustic potassa, chemically pure nitric and carbolic acids, then iodine and bromine, and, last of all, the nitrate of silver, which cannot properly be called a caustic, its action being so superficial as to give it the character of a stimulating rather than that of a destructive agent.

Many surgeons of the present day deprecate the use of caustic or destructive agents for the treatment of the majority of chancroids met with in practice, declaring that milder and less heroic measures suffice for the cure. Undoubtedly this is perfectly true, a large proportion of the simple venereal sores met with at the present day being of the mild and superficial variety, which will heal up under the use of iodoform or some such simple remedy. But the advantage of using a cauterizing agent, as long as the sore retains the appearances of inflammation and unhealthy action, is that for this condition of things it substitutes a healthy action, and obviates what not infrequently happens in chancroids, viz., a supervention of inflammation in what

originally was a superficial and mild ulceration. Besides this, a proper use of the cautery hastens the cure, and any means which does this should be used, no matter though it may not appear absolutely requisite.

APPLICATION OF CAUSTICS.—If caustics are to be applied, certain points should be carefully attended to in order to make their use effective. Selecting the one which is most active, it should be applied not only to the apparent surface of the sore, but should be carried beneath its edges, and into sound tissue to the extent of from an eighth to a sixth of an inch, or further, if the undermining process is extensive ; in other words, the entire extent of the ulceration must be thoroughly destroyed, else the healthy ulcer left after the cautery is apt to become contaminated with the matter from those portions which have not felt its action, and the inflammation then commences anew, and spreads over a broader area. The old remedies known as Ricord's and Canquoin's pastes have lately fallen into disuse, and their employment presents no advantages over simply cauterizing the ulcer with the liquid caustic, and applying cold water dressings, while it has the decided *disadvantage* of concealing the chancroid from view, and thus preventing the surgeon from knowing what is going on beneath the crust which is formed. The simpler and more effective is the agent employed, and the more accessible is the ulcer to the inspection of the surgeon, the speedier will a cure be brought about, inasmuch as the applications may then be made with sufficient frequency to insure the substitution of a healthy action for the morbid inflammation.

SUBSEQUENT DRESSINGS.—The *subsequent dressings* are those which are continuously used in the intervals between the cauterizations. Of these the *dry* are infinitely to be preferred to the *wet* dressings.' Iodoform is the agent most deserving of praise in this connection, the only objection to its use being the pungent and penetrating odor which it possesses. Many substances have been suggested for the palliation of this defect, the last agent for this purpose being chloral-hydrate, but none of them can claim a great degree of success. Perhaps the best manner of correcting the odor is to instruct the patient not to scatter the powder upon his hands or clothing ; if due attention be paid to this point, this disagreeable feature of a valuable drug may be materially modified. Besides the iodoform, the impure oxide of zinc, and powdered tannin, mixed with some inert powder like bismuth or lycopodium, in the proportion of one part of the active agent to three of the inert, is often of service. These dressings should be applied several times during the day, the ulceration being carefully bathed in hot water before each fresh application. After the preparation is dusted on, the part may be protected by the super-position of charpie or of Davison's prepared absorbent cotton, which makes an excellent dressing. Of the *wet* dressings, solutions of carbolic acid are the best, but the objection to their continued use is that they are apt to macerate the epithelium of healthy tissues surrounding the sore, to harden circumjacent parts, and to render the sore indolent and flabby. Another excellent dressing, and perhaps on the whole preferable to carbolic acid, is what is known at Charity Hospital, Blackwell's Island, as the "nitric acid wash," which is simply a fluidrachm of the chemically pure nitric acid dissolved in a pint of water. Should this produce burning and pain in the ulcer for more than three or four minutes after its application, it may be diluted ; otherwise it should be kept up to the standard prescribed. Under its use, the surface of the sore loses its grayish look and becomes covered with healthy granulations ; the purulent discharge ceases ; and the edges of the wound fill up. When this point is reached, the wash may be discontinued, and dry dressing substituted. In the treatment of this

variety of ulcer, special care must be taken to persevere faithfully with the use of the remedies until complete cicatrization has occurred, inasmuch as some chancroids become freshly inflamed, and break down anew, even when they are apparently on the high road to recovery.

The use of hot-water baths, general and local, has been recommended as another means of treatment for these ulcers, and undoubtedly in those cases which are attended with much inflammation, benefit accrues from this plan. But for the *cure* of chancroids I cannot speak in the same terms of approbation which some writers employ when speaking of the "hot-water treatment;" the utmost that I have obtained has been relief of inflammation, and this has been notably the case in phagedænic ulcers, in which, after the subsidence of the acute symptoms (the swelling, redness, and pain), the condition of the ulcer has remained stationary, requiring more active measures for its cure; and this, too, although the bath treatment had been diligently and carefully pursued.

TREATMENT OF COMPLICATIONS.

BUBO.—Buboes, according to their stage, require an abortive or a stimulating method of treatment. When first seen, and before any breaking down has occurred, the attempt should be made to cause absorption and disappearance of the swelling. For this purpose, local applications of the tincture of iodine (simple or compound) should be made to the enlarged gland, together with compression, if the condition of the swelling will admit of it. Besides this, applications of nitrate of silver—thirty, forty, or even sixty grains to the fluidounce—and of collodion, either alone or holding iodoform in suspension, have been used with varying success. The internal administration of the sulphide of calcium, in doses varying from one-tenth to one-half a grain, has in my hands not produced satisfactory results, although some writers speak highly of its use in these cases. The application of ice is occasionally of benefit in diminishing pain and reducing inflammation.

As soon, however, as fluctuation is apparent, the remedies mentioned above must be abandoned, and an opposite course of treatment pursued. Everything must now be done to favor suppuration, for the reasons which I have already given, and which will perhaps bear repetition. As already mentioned, when a bubo threatens to break down, it is impossible, until after the bubo has been opened, to declare whether it is of the kind known as "simple," or whether it is "virulent;" hence it is important to favor suppuration, and to settle this point. If the bubo be "*simple*," the mere evacuation of the pus will be almost all the treatment requisite, if we except the dressing of the wound with lint and cold-water bandages. But if the bubo prove to be what is known as the "*virulent* bubo," then the condition of things is materially altered. The ulcer which is left after the evacuation of the pus is to all intents and purposes a chancroid, and requires active measures for its cure.[1]

The first thing to be done is to destroy the inflammatory and destructive character of the ulcer, and this is best done, if the bubo be at all large, by the actual cautery in one of the methods already advised. Any glands which are not yet destroyed should be removed, either with the knife or écraseur, and whatever hemorrhage there may be should be checked with the white-hot iron. In making cauterizing applications to these, as well as to other

[1] Aspiration of the bubo in these cases is of no service; a free incision is the best method of treatment.

chancroids, care should be taken to include all portions of diseased tissue. The subsequent dressings should be detergent and stimulating, and the best articles are the nitric and carbolic lotions. These should be applied upon the absorbent cotton, well packed into all portions of the wound until it assumes a perfectly healthy appearance, when they may be discontinued in favor of a dry dressing, usually of iodoform.

PHIMOSIS.—In *phimosis*, the attempt should be made to relieve the swelling and œdema of the prepuce by frequent and continuous, hot, local baths, carried to the point of producing slight faintness. Associated with these, sub-preputial injections of the nitric or carbolic lotions should be made, conjoined with strict attention to cleanliness; as soon as the œdema subsides and retraction of the foreskin is possible, the concealed sore should be treated in the manner already advised. It is better surgery in such cases not to attempt to relieve the phimosis by incision, unless gangrene threatens to supervene, as the cut edges of the wound almost invariably become inoculated, and a large and troublesome sore results. If, however, it becomes necessary to operate, the incision had better be made double instead of single, by making one at each side of the foreskin, instead of the time-honored single cut along the dorsum of the penis. The double incision admits an easier and more thorough exposure of the glans penis and fossa glandis, and a more perfect application of the necessary remedies. The concealed chancroids, as well as the edges of the wounds, should then be cauterized in the manner and with the means already detailed.

PARAPHIMOSIS is usually a less serious accident than the complication we have just been considering, although even here the constriction may be so great as to produce gangrene of the glans penis. If this threatens, it must, of course, be relieved by a timely division of the constricting portion of the prepuce; under other circumstances, the same rule as regards incisions must be observed here as in phimosis. Antiphlogistic treatment by hot-water local baths, leeches to the abdominal rings, multiple punctures of the œdematous prepuce, and the ice-pack, are the remedies which hold out the best and most speedy means of relief; destruction of the chancroids must be always carried out as quickly as possible.

BALANITIS.—In *balanitis* the principal danger arises from the auto-inoculation of the abraded points, and hence these should be cauterized and treated in the same manner as though they were already chancroids.

CONCEALED CHANCROIDS (*Chancres larvés*, of the French), if seated just within the meatus, can generally be treated by cauterization and the dressings already advised, without any great difficulty. If seated further within the canal, the applications must be made through a speculum, for which purpose there is nothing better than a Gruber's ear-speculum. As a matter of fact, I do not believe that these ulcers are ever seated further than one inch within the canal, and the celebrated case of Ricord, described in his "Clinique Iconographique," is open to question as regards diagnosis. In many respects it looks as though it had been a case of tuberculosis, and not of chancroid.

PHAGEDÆNA.—The most serious of all complications to treat is phagedæna, and the main point to be remembered is, that it is due much more to some constitutional defect than to any local property of the chancroid; hence a twofold method must be adopted, namely, local destruction of the ulceration, and an internal treatment to alter the underlying diathesis. The only cautery

which is of any service in these cases is the actual cautery, and this should be thoroughly and mercilessly applied wherever the disease shows itself. The subsequent dressings are best made with the nitric acid lotion, and these should be carefully applied over the entire extent of the sore, the cauterizations to be repeated as long as the floor of the ulcer shows its purulent grayish hue, or the sore exhibits any tendency towards extension. The use of the potassio-tartrate of iron, so much vaunted by Ricord as the " born enemy of phage-dæna," does not seem to be as efficacious in this country as abroad, and it has the decided disadvantage of depositing the metallic tartrate of iron over the surface of the sore. Internally, as a tonic, it is sometimes of benefit.

The *internal treatment* of phagedæna must be directed to building up the patient's general health, and, of the various tonics recommended for this pur-pose—besides the preparations of iron—quinine, cod-liver oil, and phosphoric acid may be used with advantage. Care must be taken not to confound these phagedænic chancroids of the genitals and of the inguinal region with ulcer-ating gummata and serpiginous syphilides of the same regions, as those require an entirely different treatment. In chancroids, mercury and iodide of potassium not only are of no advantage, but often do positive harm, and I believe that many cases of serpiginous chancroids, which are reported as having been benefited by the " mixed treatment,"[1] are examples of serpigi-nous syphilides, and not of true phagedænic chancroids. In the large majority of cases, chancroids do not need any internal treatment; it is only in those cases in which the patients are debilitated that constitutional remedies are required, and even then tonics, such as iron or quinine, are all that are requisite. In the phagedænic variety of chancroid, tonics are, of course, a necessity.

MIXED SORE.—As regards the so-called " mixed sore," the treatment is two-fold, and must be changed as soon as the character of the local ulceration is altered. As long as the chancroid exists, the case must be treated as one of chancroid; but as soon as the ulcer assumes its syphilitic characters, the remedies applicable to the chancroid must be abandoned, and those remedies adopted which are appropriate for the treatment of the initial lesion of syphilis.

[1] [This name is applied to the combined use of mercury and iodide of potassium.]

VENEREAL DISEASES: SYPHILIS.

BY

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HISTORY OF SYPHILIS.

THE origin of SYPHILIS[1] is involved in obscurity. Whether the disease has
everywhere and at all times existed, or whether it has originated at one
period or another *de novo*, are questions which, in spite of the vast amount of
laborious erudition which has been brought to bear with a view to their
solution, cannot at present be regarded as satisfactorily answered.[2] Our
earliest positive knowledge of the disease dates to the year 1495, at which
time it appeared, of a malignant type and epidemic in character, in the
armies of France, led by Charles VIII. against the kingdom of Naples.
The disease not only attacked the invaders but also the defenders of the
Italian kingdom, and almost simultaneously overran the whole of Europe.

The earlier writers on syphilis differentiated it with accuracy from the
other venereal affections, but later authors confounded the various diseases
due to sexual intercourse, until, at the end of the last century, confusion
everywhere prevailed.[3]

The identity of gonorrhœa with syphilis was, however, denied even in the
last century by Astruc, Balfour, and Benjamin Bell, but John Hunter, who
published his work on venereal in 1786, when at the height of his great
reputation, maintained this identity, and taught that the only difference
between the two diseases depended upon the nature of the surface to which the
poison was applied; that it caused ulceration when it acted upon a cutaneous
surface, but only a purulent discharge, without breach of continuity, when
applied to a mucous membrane; and that the morbid secretion in either case
might give rise to one or the other set of symptoms according to the struc-

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[1] As the limits of an article like the present, preclude the full discussion of many points, and
necessitate the concise treatment of nearly all subjects included, I have made numerous refer-
ences through the text to monographs and papers which contain a fuller exposition, or which
take different views, of disputed questions. The reader desirous of working out any particular
topic will find in the abstracts of current literature published in the Archives of Dermatology, a
complete bibliography of syphilis during the past seven years, with an epitome of the more im-
portant papers.

[2] The best recent works on the history of syphilis are, Hirsch (Handbuch der historische-
geographischen Pathologie, 1860–4), and Haeser (Geschichte der epidemischen Krankheiten,
zweite Auflage, Jena, 1853 und 1865), in favor of the ancient origin of syphilis, and Geigel
(Geschichte, Pathologie und Therapie der Syphilis, Würzburg, 1867) against it. An excellent and
full summary is contained in Lancereaux's Traité historique et pratique de la Syphilis, 2me
éd. Paris, 1874.

[3] See Bassereau, Affections de la Peau symptomatiques de la Syphilis. Paris, 1852. A book
well worthy of the title "epoch making," and one of the most important works ever written upon
syphilis.

(447)

ture with which it came in contact. With this belief, he inoculated himself on the glans and prepuce with the discharge from a gonorrhœa; the result was the development of primary sores, followed after some months by secondary manifestations from which he was not completely cured for three years. This naturally made a great impression on his mind; he appears to have considered the experiment conclusive, and not to have repeated it upon others.[1]

Hunter's great name and the influence of his writings caused the doctrine of the identity of gonorrhœa and syphilis to prevail extensively, and, indeed, it is only within the last score of years that this view has entirely ceased to be held.[2] The treatment of gonorrhœa by means of the internal employment of mercury, even to salivation, was not uncommon in the first thirty years of this century, and it was not until 1838 that Ricord in his work on the subject[3] finally disproved the identity of gonorrhœa and syphilis.

Ricord, while clearly differentiating chancre and gonorrhœa, failed to distinguish accurately the two kinds of sore confounded under the former name, and moreover committed the lamentable mistake of denying the communicability of syphilis by the secretions of its generalized lesions.[4] His pupils, who founded the modern French school of syphilology, proceeded in Ricord's footsteps and pushed the investigations of the Master still farther, disproving some of his assertions while confirming others.

Bassereau, a pupil of Ricord, first put forward, in 1852, the theory that the two kinds of sore indicated two entirely distinct contagious diseases, having no relation to each other and each invariably only transmitting its like. He arrived at this conclusion by the confrontation of a large number of patients with the individuals from whom they had contracted, or to whom they had communicated, their disease. He found that in every case those affected with chancre followed by secondary infection, had derived their disease from persons similarly affected, with secondary infection. On the other hand, those affected with chancres not causing symptoms of general syphilis, had, without exception, derived their disease from persons who, like themselves, were the subjects of sores whose action was limited to the point first infected.[5]

Ricord had observed that the "indurated" sore could only be inoculated with difficulty upon the individual who bore it, while sores not indurated could be inoculated indefinitely. Moreover, when the indurated sore was inoculated upon its bearer, it gave rise to a sore precisely similar to that caused by inoculation from a non-indurated or "soft" sore. Therefore it was argued by Clerc,[6] that it was not necessary to imagine, with Bassereau, the existence of two poisons, but that the soft sore was the product of the hard sore when conveyed to a person already syphilitic; that it had permanently lost its infecting property, so that if transmitted further to a person who had never had syphilis, it would still be transmitted as a soft sore without any power of conveying general infection. To this hybrid or degenerated sore, Clerc gave the name of "chancroid."[7] Other observers confirmed Clerc's asser-

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[1] J. R. Lane, Lectures on Syphilis, delivered at the Harveian Society, December, 1876, page 6. 2d ed. London, 1881.

[2] Bumstead says that it was taught as lately as in 1860, in one of the most prominent medical schools of this country.

[3] Traité des Inoculations appliquées à l'Étude des Maladies Vénériennes. Paris, 1838.

[4] Although doubts as to the non-inoculability of "secondary" lesions existed in the minds of various writers previous to Ricord's time, yet his advocacy of this view silenced or convinced his contemporaries, and it was not until the inoculation experiments of Waller, of Prague (Präger Vierteljahrsschrift, 1851), and others, that the contagiousness of these lesions was generally acknowledged.

[5] Lane, op. cit.

[6] Du Chancroïde Syphilitique. Moniteur des Hôpitaux, etc. Paris, 1854.

[7] Lane, op. cit.

tions, and it was also found that the "indurated sore," which under ordinary circumstances was inoculated upon the bearer with so much difficulty, could readily be inoculated if it were first irritated by powdered savin or by a seton, and made to produce pus, and that the sore thus arising resembled in every way the soft sore, the "chancroid" of Clerc.

By this means an unfortunate step backward was taken, and the two poisons which had been so carefully differentiated by Bassereau were once more confounded together, and regarded as essentially one. But these experimenters had proved too much, for others following their lead inoculated simple nonvenereal matter of inflammatory origin upon syphilitic subjects, with the result of producing pustules and ulcers identical with the chancroid, and capable of reinoculation through a number of generations.

The result of these various observations and speculations regarding the nature of venereal sores has been the gradual evolution of the following theory, which is held by a majority of the most distinguished syphilographers of the present day, and which is accepted by the writer of this article :—

The virus of venereal sores is of two distinct kinds. Some venereal sores are due to the inoculation of the syphilitic virus, others are due to the inoculation of a distinct specific virus known as chancroidal. These two poisons may be inoculated simultaneously.[1]

GENERAL PATHOLOGY.

Syphilis is a virulent, contagious, inoculable disease, having a sluggish evolution, and manifesting itself, in the acquired form, first by a chancre, then by eruptions on the skin and mucous membranes, subsequently by chronic inflammations of the cellulo-vascular tissues and the bones, and finally by special productions in the form of small tumors or nodules called gummata.[2]

There are two forms of syphilis, the acquired and the hereditary. Both originate in the same virus, but their course, the lesions by which they are expressed, and the symptoms to which they give rise, are so different that they require a separate description.

Acquired syphilis is the disease communicated by an infected person to one free from syphilis. It first shows itself, precisely at the point of inoculation, by an *initial lesion* or chancre. Hereditary syphilis is the disease derived from one or both parents, either by conception, or through the blood of the mother after conception. In this form of syphilis the initial lesion or chancre is wanting.[3]

Is chancre the first symptom of a generalized infection, or is it in the beginning merely a local lesion? Observers are not all agreed upon the answer

[1] The other prevailing views represent the virus of chancroid either as, according to Clerc's view given above, a sort of degenerated syphilitic virus, or as nothing more than purulent infection, and the chancroid as in no way distinguishable from the product of the inoculation of pus from simple sores upon persons of peculiar constitution. Among the upholders of the latter view may be mentioned the late Prof. Freeman J. Bumstead, whose opinion justly carries great weight. I cannot, however, admit the identity of the chancroidal virus with that of simple purulent matter, for I believe that the clinical appearance and course of the chancroid are so peculiar as to establish its existence as a morbid entity. Two excellent papers by Dr. Bumstead may be referred to in this connection, viz. : "On the present state of the question of the unity or duality of syphilis," Am. Journ. Med. Sci., April, 1873, and "The virus of venereal sores, its unity or duality," Transactions of the International Medical Congress of Philadelphia, Phila., 1877. See also a review by Dr. Frederick Zinsser : "The doctrines of unicism and dualism of the syphilitic contagion." Am. Journ. Syph. and Derm., vol. i., 1870, p. 220.

[2] Cornil, Leçons sur la Syphilis. Paris, 1879.

[3] Bumstead and Taylor, The Pathology and Treatment of Venereal Diseases, 4th ed. Philadelphia, 1879.

to this question, but the weight of evidence, I think, lies in favor of the first view, and against the local character of chancre.

Those who favor the local view of chancre, point to the period of so-called "second incubation," the space of time which elapses after the chancre has appeared, and during which it lies dormant, so to speak, for several weeks before any signs of general infection occur. In opposition to this view, however, it may be remarked, that a period of incubation follows the inoculation of the virus, and that it is during this first "incubation" that the poison is penetrating the system. The chancre is, in fact, the first outward sign of the constitutional infection; the "second incubation" being indeed only a halt between two outbreaks. The fact that auto-inoculation of chancre cannot be effected (see p. 460, note), shows, I think, most conclusively, that the entire system is already saturated with the poison. This question is of practical importance, for if indeed chancre were only a local manifestation, its prompt excision might prevent infection of the system, while if it is only the first symptom of general infection, such treatment must of necessity be useless to prevent the evolution of the disease. The question of excision will be again mentioned under the head of the treatment of chancre.

SOURCES OF SYPHILITIC CONTAGION.—Up to within a comparatively recent period, it was believed that the chancre was the only contagious lesion of syphilis, and the only means whereby the disease could be spread from one individual to another. This theory was strongly supported by Ricord for many years, but this truly scientific syphilographer at last saw his error, and, recanting, uttered in a new edition of his "Letters" the expression of his change of belief.[1] We now know that the generalized lesions of syphilis are among the commonest sources of contagion, and it is no longer the custom, as it was at one time, to charge any individual presenting syphilis, no matter what his or her personal character and antecedents, with having indulged in illicit sexual intercourse. Among the generalized manifestations of syphilis those which are suppurative in character are most apt to convey the contagion. *Mucous papules and patches* are most commonly the source of infection, and after these in point of contagiousness are the pustular syphilodermata—ecthymatiform, acneiform, and rupial. The late lesions are not considered contagious, although no direct inoculation-experiments have been practised with these.

The *blood* of persons in the full course of syphilis is certainly infective,[2] but at a later period its contagious quality gradually declines, and is finally entirely lost.

The contagiousness of the normal secretions of the body—*saliva, sweat, tears, milk, semen*—has been examined into by various experimenters, with negative results, and I think we may say positively, that, as far as our present knowledge goes, none of these secretions act as the carriers of the syphilitic contagion.

MODES OF CONTAGION.—(1) *Immediate.*—The most frequent mode of syphilitic contagion is from the genital organs in sexual congress. Some abrasion of the skin is almost always if not invariably required in order to procure the entry of the virus into the system; this, however, as is known, is not uncom-

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[1] "L'homme absurde est celui qui ne change jamais," said Ricord.

[2] The contagious character of syphilitic blood has been ascertained by direct inoculation upon persons free from syphilitic disease. The fact is now universally admitted, so that it is not necessary to make any direct reference to the original investigations. Important as is the knowledge of this contagiousness of syphilitic blood, the manner in which it was gained, that is, by inoculating in some cases innocent and unsuspecting individuals, was unjustifiable and infamous.

mon in sexual intercourse. Now and then individuals are met with who appear to be quite refractory to the absorption of the syphilitic virus: such persons escape with impunity from an impure connection. Those who suffer from hereditary syphilis are believed to be exempt, and also most if not all persons who have already had the acquired disease. One attack of syphilis usually protects against a second, but this is not invariably the case; Diday[1] and others have reported cases of reinfection, where the disease ran its usual and regular course a second time. This goes to prove that syphilis is a curable disease, a fact which has been denied by some authorities. Now and then cases of contagion by the anus are observed, when this has followed as the result of unnatural intercourse.

Contagion by the mouth is next in frequency to that by way of the genital organs. It is, indeed, not very uncommon. The source of contagion in this case, however, is usually the mucous patch. The most innocent persons may in this way contract the affection by kissing or fondling children suffering from hereditary syphilis, and children may in the same manner contract the disease from nurses, or may give it to them in the act of nursing.[2]

A few years ago the following case came under my observation, which illustrates the way in which syphilis may obtain entrance to a family quite unawares. A young girl, returning from a ball, kissed on parting the young man who had accompanied her home. She had been suffering from a cracked lower lip, and was consequently not alarmed when a "fever-blister" appeared in the locality a few weeks later. As this did not heal she sought relief after a time at a dispensary, where burnt alum or borax was applied for several weeks longer, the sore growing larger and harder all the time, and "kernels" appearing under the chin. When I saw her, at this time, the girl had a well-marked chancre of the lower lip, with hazel-nut sized induration, and accompanied by enlarged submaxillary glands. On inquiring as to the health of the family I learned that an infant sister, of whom my patient was very fond, had for some little time past showed "fever-blisters" on the commissure of the lips, and on visiting the house I found the child suffering with a small chancre of the commissure, together with a general maculo-papular eruption. I at once quarantined the victims of the disease, but too late, as the mother and two more children subsequently showed generalized syphilitic eruptions, and the family remained under my care and observation for several years, showing various early and late lesions from time to time.

Syphilis is also said, with some indirect evidence of truth, to have been conveyed in the act of ritual circumcision as practised among the Jews, the operator sometimes placing the infant's penis in his mouth, previously filled with an astringent fluid, after the operation, with the view of stopping the hemorrhage.[3]

Other modes of immediate contagion are the suction of the breast, or a wound, with a therapeutic purpose, the examinations or handlings of a midwife or accoucheur,[4] or even the pressure of the body, as in cases where nurses have had chancres, the result of carrying infants upon the arm, who were suffering with mucous patches of the anus. Also, one case is recorded where a young man contracted a chancre of the thigh, of which he could give no history, save that he had permitted a ballet girl affected with contagious syphilitic lesions, and probably in very scanty attire, to sit for some time upon his knee. Syphilis is sometimes conveyed by the immediate contagion of bites.

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[1] Archives Générales de Médecine, Juillet et Août, 1862.

[2] See R. W. Taylor, The Dangers of the Transmission of Syphilis between Nursing Children and Nurses, in Infant Asylums and in Private Practice. Am. Jour. Obst., vol. viii. No. 3, Nov. 1875 ; also, Fournier, Nourrices et Nourrissons Syphilitiques. Paris, 1878.

[3] See a paper on the question of the Transmission of Syphilitic Contagion in the Rite of Circumcision, by R. W. Taylor, in the New York Medical Journal, Dec. 1873.

[4] Bardinet (Mém. de l'Acad. de Méd., Avril 14, 1874) gives the case of a midwife affected with a syphilitic lesion of the finger, through whom more than one hundred persons had been infected.

A case has been reported where a man was bitten in a scuffle by his antagonist, who had mucous patches of the mouth, and where a chancre followed in the wounded locality, and general syphilitic symptoms subsequently developed. I have observed two cases of chancre following bites: in one of these a woman was bitten upon the nipple by her lover, during endearments which were never carried to the extent of sexual connection, and in the other a man was bitten upon the scrotum by a prostitute. In both of these cases I saw the initial lesion at an early date, and followed up the history of the individuals. Similar cases are on record. The operation of skin-grafting may be the means of conveying syphilis.[1]

(2) *Mediate contagion* may occur from the passage of a cigar[2] or pipe from mouth to mouth, from the use of various common utensils,[3] from sleeping in the same bed, or from workmen using such tools as are passed from mouth to mouth, as the blowpipes employed in glass works.[4] Surgical instruments may convey contagion.[5] Tattooing has sometimes been the means of conveying the poison of syphilis, as in the interesting series of cases, fifteen in all, reported by Maury and Dulles.[6] Accoucheurs and midwives may become the sources of mediate as well as of immediate contagion. A case has been recorded in which the secretions of the female genitalia were the means of contagion. A woman had connection with a man having an infecting lesion upon the penis, and a few hours after with another man who had never previously had syphilitic disease. The second lover contracted a chancre from this intercourse, while the woman whose vaginal secretions had carried the contagion remained healthy.

In the early history of syphilis, it was imagined that the contagion could be carried by the air as smallpox could, and cases are on record where persons have been accused of conveying syphilis by whispering in the ear. We now know this to be a notion without foundation, and that actual contact is necessary. Another idea which was prevalent to within recent years was, that an infant could contract syphilis from the mother in birth, as it passed through the parturient canal. Why this peculiar theory should have gained currency is hard to say. I believe it is entirely unsupported by any recorded cases.

Many other means of contagion have been recorded by various writers which it is not necessary to enumerate, but the fact should be borne in mind in investigating obscure cases, and the physician should not be too hasty in imputing immorality when outward circumstances are against this view, and when even a possibility of mediate contagion exists. One case may be mentioned. Clerc, a man not likely to take a credulous view of infection, showed to his pupils an old man of seventy, who had not indulged in sexual intercourse for many years. This man presented a chancre of the glans penis, derived from the rubbing of the organ against the front of a pair of suspected pantaloons which he had worn about two months.[7]

VACCINO-SYPHILIS.—The question of the conveyance of syphilis in vaccination is one of great practical importance. The possibility of such an occur-

[1] See Deubel's case. Gaz. Méd. de Paris, Nov. 5, 1881, p. 628.
[2] Two Cases of Chancre of the Lip, probably acquired through Cigars. Transactions of the American Dermatological Association. Archives of Dermatology, Oct. 1879.
[3] See a Case of Syphilitic Inoculation by a Tooth-brush, by E. B. Baxter. Lancet, May 31, 1879.
[4] Rollet, Arch. Gén. de Méd., 1859 ; Gaz. Méd. de Lyon, Nov. 16 et Déc. 1, 1862. Also Dechaux, Épidémie syphilitique à la verrerie de Montluçon. Gaz. Méd. de Lyon, Nos. 15 et 16, 1867.
[5] As the Eustachian catheter. See Laillier and others, in Bull. et Mem. de la Soc. Méd. des Hôpit. de Paris, année 1864, pp. 299, 213, et 1865, pp. 134, 136.
[6] Am. Jour. Med. Sci., Jan. 1878.
[7] See also Hyde, On Some Sources of Syphilitic Infection (American Journal of the Medical Sciences, January, 1874), and Rohé, Two Cases of Syphilis in which the Infection took place in rather Unusual Situations (Chicago Medical Journal and Examiner, July, 1878).

rence was suggested as far back as the beginning of the present century, but general attention was drawn to the subject only as recently as 1852, when a veterinary surgeon of Berlin was condemned to fine and imprisonment for having conveyed syphilis to nineteen individuals by vaccination. The virus was conveyed by an infant, whose health appeared perfectly good up to the day of vaccination, but who, seven days afterwards, broke out with a general erythematous syphiloderm. In 1861 occurred the famous epidemic of Rivalta, a small Italian village of 2000 inhabitants. Two series of vaccinations were performed, with an interval of ten days. Some time after the first, thirty-eight children showed manifest symptoms of syphilis; in the second, one of these thirty-eight transmitted the disease to seven persons. These facts, as well as others subsequently reported, attracted much attention, and the subject has of late years been studied with the result of making the symptoms and course of this form of disease much better known than formerly.

A remarkable fact is, that in many of the reported endemics, the syphilitic manifestations appeared at different times and in different forms in the various infected individuals. Some showed an early occurrence of characteristic cutaneous and mucous eruptions, while in others the disease appeared at a later date, in the form of a lesion limited to the point of inoculation, generalized manifestations not appearing for four or five weeks more. Another confusing circumstance was, that, many cases being inoculated with a liquid from the same source, the operation conveyed to some vaccinia, or syphilis, only, while others showed both affections simultaneously. In certain rare cases the vaccinifer was found to be healthy. Viennois explained these apparently contradictory phenomena by showing that, when syphilis is transmitted by means of vaccination, the first lesion is a chancre at the point of inoculation, appearing after the usual period of incubation, and followed after the customary interval by general symptoms. When, however, the symptoms appear suddenly some days after inoculation, they cannot be regarded as the direct consequence of this procedure. Clinical observation has shown that the modification induced in the organism by vaccination may precipitate the appearance of eruptive symptoms, in cases of individuals under the influence of syphilis.

It remains to determine the agent of the contagion. The liquid of the vaccinal vesico-pustule cannot be held accountable, since, in many of the infants vaccinated in the course of the various " epidemics," no syphilis followed. As we know that the blood of syphilitics is poisonous and infective, it appears likely that this was inoculated in the cases of transmission reported. The history of the cases makes this more sure, since it points to certain series of cases, where those vaccinated first from the arm of a syphilitic vaccinifer remained intact, while those near the end of the list, when the vesico-pustule was scraped by the lancet in order to obtain the last drops of vaccinal fluid, suffered infection. It should be said, however, that all writers are not in accord regarding the theory that the blood alone is the infective agent in these cases. Epidermic scales, leucocytes, and lymph, according to some observers, may also be the vehicles of contagion. It has been asked whether the blood of an individual who has received the double inoculation of vaccinia and syphilis is virulent already at the moment when the vaccinal pustules are developed—that is, about the seventh day—and consequently before the appearance of the chancre. The fact is as yet doubtful, although the following case seems to favor the affirmative : During the epidemic of Rivalta, a certain patient, who had served to vaccinate, on the 12th of June, seventeen infants, of whom seven were subsequently affected with syphilis, observed her vaccine pustules changing to indurated ulcers. On the 2d of August, the patient's skin became covered with an erythematous syphiloderm.

To sum up: Vaccino-syphilis may be derived from two sources, the vac-

cinifer and the vaccinated. The contagion is carried by means of the blood, and possibly by the epithelial scales and the white globules, and may infect either the vaccinifer or the vaccinated.[1]

Fournier says that to distinguish between vaccinal syphilis (that when infection and vaccination are simultaneous) and the syphilis which is post-vaccinal (that declared in a congenitally diseased infant after vaccinia), it should be remembered:—

(1) That in vaccinal syphilis there is a chancre at the point of inoculation with characteristic adenopathy of vicinity, while in infantile syphilis there is no chancre, but cutaneous, glandular, visceral, osseous, and other lesions.

(2) The evolution of vaccinal syphilis is accomplished in the four periods of (*a*) twenty-day incubation, (*b*) explosive chancre, (*c*) forty-five-day incubation, (*d*) explosion of generalized symptoms.[2]

General Syphilis always Follows a Chancre.—Experience and also the results of accurate statistical inquiry show that in the vast majority of cases of secondary syphilis, the existence of a previous chancre can be proved. Bumstead and Taylor give collated statistics of 1291 cases, in all of which, with the exception of 22, general syphilis was preceded by a chancre. These statistics, together with the fact that chancres are capable of spontaneous cicatrization, and may entirely disappear without leaving a trace, and also that in some situations, as the interior of the urethra, vagina, cervix uteri, and the buccal and rectal cavities, they may escape notice or be almost impossible to detect, render it extremely probable (indeed, it may be said certain) that general syphilis invariably originates in a chancre. It should be added that very many persons have had chancre without being aware of the fact, and that chancres are sometimes detected upon the persons of patients who are quite ignorant of their character and even of their presence. The chancre is often the most insignificant of all lesions.

The initial lesion of syphilis is always a chancre, whether the infection has been derived from a chancre in the giver or from a secondary lesion.

Syphilis has a certain definite period of incubation between the appearance of the chancre and the outbreak of the generalized lesions, which varies according to Diday's statistics[3] between 25 and 105 days, the average (of 52 cases) being 45 days.[4]

Bumstead and Taylor (op. cit.) sum up the matter in the following propositions:—

A venereal ulcer which is not subjected to specific treatment (so called) will usually, if at all, be followed by secondary symptoms within fifty days, and always within six months.

Conversely : The earliest symptoms of general syphilis (except in cases of hereditary origin) have been preceded by a chancre, probably within fifty days and certainly within six months.

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[1] Jullien, Traité pratique des Maladies Vénériennes. Paris, 1879.

[2] A series of excellent papers by Dr. Frank P. Foster, of New York (Am. Jour. Syph. and Derm. vol. i., 1870, pp. 189, 293 ; vol. ii., 1871, p. 38 ; vol. iii., 1872, pp. 152, 318 ; vol. iv., 1873, p. 201), gives a complete review of the subject of vaccinal syphilis. See also a review by Dr. M. H. Murray, in the same Journal, vol. iv., 1873, p. 112, and see also Hutchinson, Illustrations of Clinical Surgery, Fasc. vi.

[3] Diday, Nouvelles Doctrines sur la Syphilis, p. 265.

[4] Excluding one case in Diday's statistics where the inoculation was 105 days, the next highest figure is 70 days, and the average would then be much less. Bumstead and Taylor in giving these statistics remark that in 38 of the 52 cases, or in about four-fifths, this period was from 35 to 50 days.

Fournier[1] gives the following striking analysis of the "drama" of the apparition and development of syphilis.

FIRST ACT : *Contamination.* The virus penetrates the organism by one mode or another.

FIRST INTERVAL : *Apparent repose of the organism—incubation.* Nothing appreciable betrays the disease as yet.

SECOND ACT : Production at the point where the virus has penetrated, and only here, of a lesion called initial, which for the time constitutes the only expression of the disease.

SECOND INTERVAL : *Another period of repose of the organism.* The initial lesion continues to be the only symptom by which the disease is expressed.

THIRD ACT : *Explosion of multiple and disseminated lesions, beyond and outside of the seat of contamination.* This is the period of visible generalization of the disease.

SYPHILIZATION.—Between the years 1844 and 1850, Dr. Auzias Turenne, of Paris, brought forward and urged a theory of the prevention and cure of syphilis by means of "syphilization," asserting that repeated and successive inoculations of the syphilitic virus would produce in animals and men a syphilitic saturation, and, as a result of this, certain immunity from a second infection of the same virus. Following him, Sperino, of Turin, as a result of numerous experiments, maintained that repeated and successive inoculations of the syphilitic virus, carried to saturation, would procure not only immunity against the infection of this same virus, but would also serve to cure the various syphilitic manifestations, initial as well as generalized. At the time this theory was brought forward, no clear distinction was made between the virus of chancroid and that of syphilis. We now know that, while the chancroid is auto-inoculable, the unirritated chancre is not at all, or rather only very rarely, inoculable on the individual bearing it. Auzias Turenne, and those who shared his belief, usually inoculated the chancroid, and, finding that after repeated inoculations the sore could no longer be reproduced, concluded that the individual was saturated with syphilis and incapable of infection. He proposed syphilization as a prophylactic measure to be employed upon the community at large, and his earnest, impassioned, and persistent advocacy of his peculiar views gained for them an amount of attention which, in the present state of our knowledge, it is difficult to understand. At present we know that the inoculation with venereal virus can have but two results, either (1) the individual experimented upon is already syphilitic, in which case the inoculation, if made with syphilitic virus, will be without effect—inoculations made with chancroidal virus, however, being capable of indefinite repetition ; or (2) the individual is free from syphilis, when the first inoculation of syphilitic virus will give him the disease ; he will be in the same category as the former individual ; and further inoculations will be without effect, while, as before, chancroidal virus may be reinoculated indefinitely.

Boeck, of Christiania, was the most illustrious disciple of Auzias Turenne, and worked for years at the subject, finally compassing sea and land to make converts to his views, which were everywhere received with attention, fully investigated, and—rejected. Put to the test of careful observation by disinterested investigators, the theory of syphilization was found to have absolutely no foundation in fact, and with the death of its enthusiastic advocates, Auzias Turenne and Boeck, the theory also died out completely.[2]

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[1] Leçons sur la Syphilis. Paris, 1873.

[2] For a fuller exposition of the theory of syphilization, the curious reader may refer to Bumstead's work (3d edition), and to Report of Cases treated at Charity Hospital (Am. Jour. Med. Sci., July, 1870). Also to the original papers and works of Auzias Turenne (De la Syphilisation ou Vaccination Syphilitique. Arch. Gén. de Méd., 1851, 4e sér. t. xxvi.); Sperino (La Syphilisa-

SYPHILIS IN ANIMALS.—Although the chancroidal virus has been success-fully inoculated upon animals, yet syphilis has never yet been produced in any of the brute creation, though very numerous efforts have been made to attain success in such inoculations, and though a variety of animals have been made the subjects of experiment. Thus, inoculations have been practised upon the monkey, dog, cat, horse, mule, sheep, rabbit, rat, Guinea-pig, and heifer, but invariably without result.[1] There is, however, room for further investigation in this direction.

REINFECTION IN SYPHILIS.—Syphilis commonly occurs but once in the same person. The immunity conferred by one attack is just as great as in the case of the various other contagious and constitutional diseases—smallpox, scarlet fever, etc. Most of the numerous cases of syphilitic reinfection reported have been cases where lesions have relapsed after a certain interval, or where the observations were so imperfect as to throw much doubt upon their accu-racy. In most instances a recent attack of syphilis may be recognized— (1) By the induration of the preceding chancre and neighboring lymphatic ganglia. (2) By the time elapsing between the appearance of the suspicious ulcer and that of the general symptoms, the interval, when the latter are dependent upon the same infection as the former, and in the absence of treat-ment, being very uniformly about six weeks, and rarely exceeding three months. (3) By the character of the lesions, whether belonging to an early or late stage of syphilis. In the absence of these signs we may ascribe the lesions to an old infection. Before we can admit a second attack of syphilis, we must have an undisputed history of the first infection; we must have proof beyond doubt of a second chancre, which is followed by *well-marked enlargement of the inguinal ganglia,* and at a later period *by secondary mani-festations of an undoubtedly syphilitic nature.* Without this succession of lesions similar to those of the first attack, we cannot admit the claims of any case of syphilitic reinfection.[2] A very considerable proportion of the reported cases of so-called syphilitic reinfection are nothing more than relapsing lesions of the original attack.[3]

THE EVOLUTION OF SYPHILIS.—Writers upon syphilis usually classify the manifestations of the disease under the heads "Primary," "Secondary," and "Tertiary." This is, however, as regards the last two divisions, an arbitrary dis-tribution, and one not always according to nature. For the "tertiary" lesions do not invariably appear in their due time, but may show themselves in the "secondary" period, without regard to preconceived ideas of their proper sequence, and without following the precedence commonly assigned to them. For this reason I prefer to classify the various stages in the evolution of syphilis as follows: (1) Period of the initial lesion or chancre; (2) Period of generalized lesions. These latter I shall consider according to their anatomical seat, and not generally according to their received chronological development. Hereditary syphilis, as *sui generis,* must be considered separately.

The evolution of the various lesions commonly occupies about the same

tion etudiée comme méthode curative et comme moyen prophylactique des Maladies Vénériennes. Paris, 1853); and Boeck (Syphilisationen Studeret ved Sygesengen. Christiania, 1854; and On Syphilization, Am. Jour. Syph. and Derm., vol. i., 1870, p. 1).

[1] See Traité théorique et pratique de la Syphilis et des Maladies Vénériennes, p. 85. Par MM. les Docteurs L. Belhomme et Aimé Martin. 2me ed. Paris, 1876; and Jullien, op. cit., p. 547.

[2] Bumstead and Taylor, op. cit., p. 421.

[3] See Kobner, Reinfection in Constitutional Syphilis. (Berlin. klin. Wochens., Nov. 1872. Translated in Am. Jour. Syph. and Derm., vol. iv., 1873, p. 128.)

chronological period, but this may be modified by the constitution and age of the patient, and still more by treatment.

The following Table gives approximately the date of development of the various lesions following the appearance of the chancre. It may be of service in giving a general idea of the duration of the disease in any given case, but cannot be depended upon invariably, because, as has been remarked, treatment and other circumstances may modify the evolution of syphilis to a considerable degree. It has been compiled from various sources by Martin,[1] and is here quoted from Bumstead and Taylor :—

Symptoms.	Date of usual development.	Date of earliest development.	Date of latest development.
The erythematous syphiloderm	45th day	25th day	12th month
Papular syphiloderm	65th "	28th "	12th "
Mucous patches	70th "	30th "	18th "
Secondary affections of the fauces	70th "	50th "	18th "
Vesicular syphiloderm	90th "	55th "	6th "
Pustular "	80th "	45th "	4 years
Pustulo-bullous syphiloderm ("Rupia") . . .	2 years	7th month	
Iritis	6th month	60th day	13th month
Syphilitic sarcocele	12th "	6th month	34th "
Periostitis	6th "	4th "	2 years
Tubercular syphiloderm	3–5 years	3 years	20 "
Gummy tumors	4–6 "	4 "	15 "
Onychia	4–6 "	3 "	22 "
True exostosis	4–6 "	2 "	20 "
Osteitis, changes in the bones and cartilages . .	3–4 "	2 "	41 "
Perforation and destruction of the velum palati .	3–4 "	2 "	20 "

CHANCRE.

The chancre is the first local manifestation of syphilis. It appears at the point where the syphilitic virus has been inoculated, showing itself after an average incubation of from about twenty to thirty days.

Although twenty-one days is given as the average period of incubation of the chancre, it must be remembered that in practice quite a considerable variation from this figure in both directions is encountered. Perhaps it would be safe to allow from fifteen to thirty-five days as the ordinary limit of variation. The following table[2] gives the result of a large number of observations by different syphilographers :—

[1] De l'Accident primitif de la Syphilis constitutionelle, p. 87. Paris, 1863.
[2] Jullien, op. cit., p. 552.

Duration of incubation.	Diday.	Le Fort.	Mauriac.
1 day	1 case	0 case	
3 days	0 "	3 cases	
4 "	0 "	2 "	
5 "	1 "	2 "	
6 "	0 "	6 "	1 to 10 days 0 cases.
7 "	0 "	3 "	
8 "	2 cases	49 "	
9 "	1 case	11 "	
10 "	2 cases	35 "	
11 "	2 "	2 "	
12 "	5 "	17 "	
13 "	0 case	5 "	
14 "	0 "	5 "	
15 "	4 cases	114 "	10 to 20 days 3 cases.
16 "	1 case	5 "	
17 "	0 "	4 "	
18 "	2 cases	5 "	
19 "	0 case	2 "	
20 "	1 "	13 "	
21 "	2 cases	20 "	
22 "	1 case	8 "	
23 "	1 "	7 "	
24 "	1 "	10 "	20 to 30 days 5 cases.
25 "	0 "	9 "	
26 to 30 days	1 "	56 "	
5 weeks	0 "	10 "	30 to 40 days 14 cases.
6 "	0 "	20 "	40 to 50 days 15 "
7 "	0 "	3 "	50 to 60 days 5 "
2 months	0 "	10 "	60 and above 8 "
3 "	0 "	2 "	
	28 cases	438 cases	50 cases.

The typical chancre, as seen on the genitals, begins as a faint erythematous point, which rapidly develops into a pin-head sized papule, slightly eroded on its surface, and usually looking like a mere abrasion. As a lesion it is trifling. As Fournier remarks, it is "the smallest, the most superficial, the most benign, the most insignificant of all possible erosions." This abrasion or erosion is roundish, oval, or sometimes linear, and covered, excepting at its border, with a grayish pellicle (Plate IX. Fig. 1). It suppurates very slightly; is, indeed, scarcely more than slightly moist on the surface. In some cases it grows no larger; in other instances it increases in size progressively until it may attain the diameter of a centimetre or more, its base meanwhile becoming firmer and larger—indurating, in fact, until it has reached maturity (Plate IX. Fig. 2).

In some cases the chancre first shows itself as a large papule, but after a time the surface of the lesion becomes excoriated or slightly ulcerated, and follows the same course as the typical lesion just mentioned. The floor of the chancre is very slightly eroded, the edges sloping gradually, not clear cut and excavated as in the case of chancroid. Now and then, however, venereal sores are met with where considerable inflammation and suppuration have occurred, and where the edges of the sore are more or less excavated. In these cases it is impossible to distinguish the nature of the lesion at first, and the diagnosis for the time must be held in suspense. If the sore is a chancre, the characteristic induration of its base supervenes.

INDURATION OF CHANCRE.—This induration is an important element in the characteristic picture of chancre. It usually shows itself in the first week of the sore. Sometimes, however, it is delayed for two or three weeks. It is

PLATE IX.

Various Forms of Chancre.
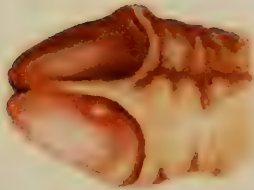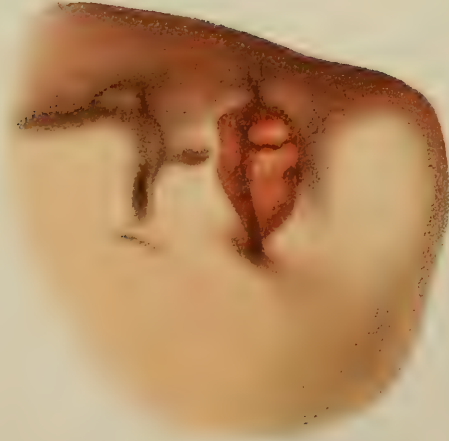
slight at first, but gradually increases in amount up to the time when the chancre heals over, when it begins to decrease again and gradually disappears, usually within a few weeks, but sometimes not for months. The induration underlies and surrounds the sore, which lies in it as if in a cup. When the sore is large and ulcerated the induration may be comparatively slight—so slight as to be called "parchment induration." In other cases the induration is very considerable, raising the sore decidedly above the level of the surrounding skin. This is the *ulcus elevatum*[1] of certain writers (Plate IX. Fig. 3).

Induration is more marked in some localities than in others; thus, in chancres of the preputial mucous membrane, the corona glandis, and the balano-preputial groove, induration is apt to be more decided than in chancres of the skin. In women induration rarely occurs to a marked degree. It is, however, rarely absent in any case, and forms one of the most distinctive characteristics of the chancre. Now and then a small abscess forms in the induration just as it begins to be absorbed. Occasionally the induration ulcerates, so that it sometimes looks as if a new chancre were forming on the seat of the old one.

VARIOUS FORMS OF CHANCRE.—Fournier[2] gives an excellent description of the various clinical aspects presented by chancre as ordinarily met with. He gives the four following types: 1. The *erosive*, desquamative chancre; 2. The *exulcerative* chancre; 3. The *ulcerative* chancre; 4. The *papular* chancre. The *erosive* chancre consists simply of an epidermic or epithelial desquamation, which merely denudes the derma without excavating it. The *exulcerative* chancre attacks the derma superficially, laying it bare but not actually excavating it. The *ulcerative* chancre, on the other hand, is hollow, excavated, jagged—an ulcer in fact, but an ulcer at the expense of its own tissues. Finally, the *papular* or elevated chancre is situated on a sort of raised plateau, and forms a disk rising above and sharply defined from the surrounding tissues; it sometimes assumes the appearance of the *ulcus elevatum* mentioned above.

A further variety of chancre is worthy of mention; it is that known as the "*multiple herpetiform*" chancre, where half a dozen or a dozen lesions appear simultaneously. Care must be taken not to confound these lesions with those of simple herpes progenitalis, which they sometimes closely resemble.

"Mixed chancre" is the name given to the sore resulting from the inoculation of the syphilitic and the chancroidal virus at the same point. A person having a chancre may have connection with another individual free from syphilis, but having a chancroid, and may contract a chancroid on the very syphilitic sore, the two diseases running their course side by side. Or a person having a chancroid may have the sore inoculated with syphilis. The "mixed chancre" is not an entity; it cannot be transmitted from generation to generation as such.

CHANCRE USUALLY SOLITARY.—The chancre is usually solitary,[3] the reason being that the virus is not auto-inoculable. To have more than one chancre

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[1] This term is also applied by some writers to the chancroid. Vide *supra*, p. 424.]

[2] Op. cit., and also in Annales de Dermatologie et de Syphiligraphie, n. s., t. i. p. 750, from Jour. de Méd. et Chir. Pratiques, 1880.

[3] Fournier (op. cit., p. 75) gives the following statistics, relating, however, to women only: Of 203 patients observed, 134 had a single chancre; 52 had two; 9 had three; 4 had four; 3 had five; and 1 had six chancres. He also gives, as extraordinary, one case where nineteen and another where twenty-three chancres occurred simultaneously.

we must have simultaneous inoculations at various points.[1] The solitary character of chancre is important from a diagnostic point of view.

CHANCRE INVOLVES THE NEIGHBORING LYMPHATIC GLANDS.—The chancre almost invariably[2] gives rise to involvement of the neighboring lymphatic glands, the glands affected being multiple, separate, so that they can be rolled under the finger, hard, indolent, without change of color, and, unlike the lymphatic engorgement of chancroid, only very rarely suppurating. The lymphatic engorgement of chancre is gradually absorbed, and disappears in a variable length of time.

It often happens, when the duration of the chancre is prolonged beyond the ordinary limit, perhaps to three or four weeks, that the "constitutional" or generalized symptoms manifest themselves concomitantly.

CHANCRE RARELY COMPLICATED BY INFLAMMATION OR PHAGEDÆNA.—The chancre is very rarely complicated by phagedæna or gangrene, and seldom even shows inflammatory symptoms. After remaining for some days stationary at its period of full development, it tends to heal over, and is generally completely cicatrized at the end of a month.

CHANCRE MAY BE TRANSFORMED INTO A MUCOUS PATCH.—When the chancre takes on the form called *ulcus elevatum*, it often closely resembles the mucous papule, and may easily be mistaken for this lesion; indeed, when the general eruption takes place before the chancre is completely cicatrized, the latter is occasionally transformed into a mucous patch.[3]

RELATIVE FREQUENCY OF CHANCRE OF DIFFERENT LOCALITIES.—Chancre has no exclusive place of election: it occurs wherever the syphilitic virus has been deposited on an absorbing surface. Of course the genitalia are by far the most frequent seat of the lesion, being affected in about the proportion of 95 of every 100 instances.

The relative frequency of chancre in the various genital regions is shown in the following tables.

SEAT OF GENITAL CHANCRES IN THE MALE.

(Clerc's figures.)		(Fournier's figures.)	
Total number	394	Total number	445
Internal surface of the prepuce .	63	Glans and prepuce	314
Balano-preputial fold . . .	171	Preputial furrow	60
Orifice of the prepuce . . .	35	Multiple, that is showing chancres	
Frænum	14	of the furrow and prepuce, or of	
Glans	12	the furrow and glans . . .	11
Meatus urinarius	33	Meatus urinarius	32
Cutaneous surface of penis or prepuce	58	Intra-urethral	17
Scrotum	3	Scrotum	7
Peno-scrotal angle	5	Peno-scrotal angle	4

[1] Fournier inoculated the discharge of ninety-nine chancres upon the patients themselves and succeeded in but one instance, in which the experiment was performed within a very short period after infection. Puche states as the result of his experience that auto-inoculation of the chancre is successful in only two per cent. of cases. Poisson obtained like results in fifty-two cases, and Laroyenne was unsuccessful in every one of nineteen. (Bumstead and Taylor, Pathology and Treatment of Venereal Diseases, 4th ed., p. 436.)

[2] So invariably that the glandular involvement is a better sign of chancre than even induration.

[3] See Fournier, Des Indurations secondaires et des Transformations du Chancre. Annales de Dermatologie et de Syphiligraphie, t. iii. p. 255.

Seat of Genital Chancres in the Female.

(Fournier.)

Total number	249
Labia majora	114
Labia minora	55
Fourchette	38
Neck of the uterus	13
Clitoridian region	10
Vulvo-vaginal orifice	9
Meatus urinarius, or urethra	7
Superior commissure of vulva	2
Vagina, properly so called	1

Genital Chancres.

Among genital chancres, those of the *urethra* in the male and of the *cervix uteri* and *vagina* in the female deserve especial notice.

Chancres of the Urethra.—Chancres of the *meatus* are not by any means as rare as those of the deeper portion of the urethra. Jullien,[1] in a total of 1773 chancres collected by himself, reports 89 chancres of the meatus and but 17 of the deep urethra. Bumstead and Taylor[2] have seen several examples, one, two, and even three inches from the orifice. Keyes[3] has observed two, one of which was one and a quarter inches from the meatus. Hyde[4] has also observed two cases. When the meatus is involved, the chancre, incessantly irritated by the urinary current, sometimes presents the irregular appearance of chancroid; it is irritable, and is said to possess a tendency to phagedæna. The deformity frequently occasioned is characteristic, the induration (late sometimes in its appearance) causing the glans to look as if carved out of wood. A peculiar, square, somewhat enlarged urethral orifice is the occasional result of chancre in this situation. To perceive the induration of chancre of the meatus or *deep urethra*, the penis should be grasped between the thumb and forefinger in an antero-posterior direction. The attention is usually first attracted by a slight impediment to urination, and a purulent discharge, due to a surrounding urethritis set up by irritation in the mucous membrane of the neighborhood, the case resembling one of anomalous gonorrhœa.[5] With the endoscope, chancre of the deep urethra can be seen as an erosion of the urethral walls, which have a grayish-red color.

Chancre of the urethra is not usually painful. A characteristic sign, which is mentioned by Bumstead and Taylor, consists in inflammatory thickening of the prepuce on either side of the frænum. The symptom is so constant as to be of considerable diagnostic value. Other aids to the diagnosis between chancre of the urethra and gonorrhœa are the slight, gluey, perhaps bloody, discharge, the localized impediment to urination, the subacute course of the lesion, and the involvement of the inguinal glands.

Chancre of the urethra, especially when deeply situated, sometimes results in stricture to a greater or less degree, which must be divided with a knife.

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[1] Op. cit., p. 582.   [2] Op. cit., p. 571.
[3] The Venereal Diseases. New York, 1880, p. 89.
[4] Chancre of the Meatus and Urethra in the Male. Chicago Med. Jour. and Exam., Aug. 1880.
[5] The occurrence of chancre of the urethra has been thought the cause of Hunter's mistake in taking gonorrhœa to be a syphilitic manifestation. John Hunter inoculated himself with the matter from a gonorrhœa, the result of which was the development of primary sores followed by general infection of the system. Ricord believed that Hunter had accidentally inoculated himself from a urethral chancre, but Lane (op. cit., p. 6) suggests the greater probability of conveyance of the syphilitic poison by the blood or morbid secretions of the person from whom the gonorrhœal matter had been taken.

At times local medication must be used in addition to general treatment. Bumstead and Taylor recommend the use of bougies made of mercurial ointment two parts, and white wax six parts. Occasionally iodoform, one drachm to each ounce of the other ingredients, may be employed.

CHANCRE OF CERVIX UTERI.—Chancre of the *cervix uteri* was formerly regarded as an extremely rare lesion. Fournier, however, met with 13 cases in a total of 249 chancres of the female genitalia, and quite a number of cases have been reported by other observers. It is undoubtedly more common than statistics would seem to indicate, and must often pass unnoticed.

In the majority of cases, this form of chancre occupies the central portion of the cervix, seeming to lose itself in the orifice. It is commonly single, but may be multiple, and varies in size from that of a bean to that of a small coin, sometimes even reaching a diameter of three centimetres. When it occurs of small size it probably often escapes observation. As chancre of the cervix uteri is continually bathed by the various secretions of the locality, its color is less bright than that of the lesion as found on the skin, the surface often being whitish, gray, grayish-yellow, or greenish. Sometimes it is cup-shaped and excavated, particularly when eccentric, with smooth and varnished bottom and borders sharply defined by a purplish or grayish, rose-colored collarette. (See Plate IX. Fig. 5.) At other times it is less sharply circumscribed, and its surface is prominent, mammillated, and vegetating, or at times pultaceous. The secretion from chancre of the cervix uteri is commonly scanty or absent.

Induration, although undoubtedly present in these cases, is usually difficult to make out by palpation. In the case of a woman suffering from prolapse of the uterus, on whose cervix a chancre was found, Ricord was able to perceive, on palpation, a sub-chancrous mass of almost wooden hardness, easily defined from the tissues of the surrounding organ.

Chancre of the cervix uteri is *indolent* and *painless*. It does not indicate its presence by any subjective symptom whatever, and is, therefore, as a general thing, only discovered by accident.

Ganglionic involvement is in some cases difficult to recognize, while in others it is due, when present, to the coexistence of other sores than those on the cervix, a circumstance peculiarly liable to occur. In thirty-four cases of chancre of the cervix uteri observed by Fournier,[1] only fifteen were single. In the nineteen remaining cases other ulcers could be seen, thirteen times on the labia, three times on the fourchette, once on the meatus, and twice on the integument about the anus. This circumstance of the multiplicity of lesions may perhaps be explained by the common observation that herpes of the genitals is an almost constant accompaniment of chancre of the cervix uteri.

The *diagnosis* of chancre of the cervix uteri can often be made only after careful examination. It is most likely to be mistaken for *chancroid* of the same locality, but the latter lesion usually shows more excavation and more decided loss of substance, with undermined and eroded edges surrounded by a reactive inflammatory area. The surface of the chancre, on the other hand, is usually flat and sometimes elevated, without a very sharply defined border. The floor of the chancroid is rough, uneven, eroded, and covered with a yellowish secretion, while that of the chancre is smooth, as if varnished, grayish, or flesh-colored, and exuding a scanty sero-purulent or sanguinolent discharge. The floor of the chancroid is soft, that of the chancre hard.

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[1] Verbal communication to M. Jullien of later date than the statistics given before. See Jullien, op. cit., p. 588.

DIFFERENTIAL DIAGNOSIS BETWEEN CHANCRE AND CHANCROID OF THE CERVIX UTERI.

(Fournier, op. cit., p. 300.)

CHANCRE OF THE CERVIX.	CHANCROID OF THE CERVIX.
I. Habitually single on the cervix. Rarely multiple.	I. Single or multiple (often single from the fusion of several neighboring sores).
II. Commonly of limited extent.	II. Often extensive.
III. Always erosive, or papulo-erosive.	III. Sometimes ulcerative with irregular jagged edges; sometimes also papular, but with irregularities of surface depressions and elevations.
IV. Of an opaline tint, grayish and pseudomembranous.	IV. Yellow or yellowish in color, and of a brighter tint than the grayish dusky shade of the chancre.
V. Coincidently, at the vulva, either absence of any lesion, or chancres.[1]	V. Coincidently, at the vulva, chancroids of unmistakable character, and more or less numerous. In some cases chancroids in the vaginal ampulla in the neighborhood of the cervix.
VI. Auto-inoculation negative.	VI. Auto-inoculation producing a chancroid.

The bracket labels to the left of the Chancre column read: *Equivocal signs.* and *Signs of a probable character.*

Chancres of the cervix must sometimes be differentiated from *follicular ulcers*. These are small, cup-shaped, situated in the follicles, and usually no larger than the follicle from which they are derived. Catarrh of the cervix, hypertrophy of the cervix, fluor albus, etc., are also accompaniments of follicular ulceration of this region. *Simple erosions* sometimes resemble chancre, but only in the earliest stage of the latter. *Papillary erosion*, a metamorphosis of simple erosion characterized by the dark red points of papillæ denuded of their epithelium, which are scattered over the surface and accompanied by cervical and vaginal catarrh, must also be differentiated. The so-called *herpetic ulcer* may sometimes resemble chancre, but it is apt to be multiple, and the lesions run together forming an irregularly outlined sore. In addition, little herpetic ulcers tend to rapid cure. *Carcinoma* is distinguished from chancre of the cervix uteri by its crater-like excavation, the depth of the sore, with irregular, thick, hard, bosselated edges; the uneven floor, covered with a dirty, purulent, and ill-smelling secretion; the frequently accompanying hypertrophy of the cervix, with immobility of the uterus itself as the growth progresses; the occasional stubborn bleeding; the pain; and finally the age of the patient. *Tuberculous* ulcers of the cervix are almost unknown as primary appearances, and are accompanied by signs of tuberculosis in other organs.[2]

CHANCRES OF THE VAGINA.—Chancre of the vagina (excepting in that portion immediately within the vulvar ring), is excessively rare. Among 249 chancres of the female genital organs, Fournier saw only one in the vagina, and that doubtful. Binet,[3] in 128 chancres of the female genitalia, only observed two cases. The vaginal mucous membrane with its thick layers of epithelium is seldom eroded in sexual intercourse, and this will account for

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[1] A reservation must be made in the possible but exceptional circumstance of double contagion.

[2] See an excellent article on the diagnosis of chancres of the cervix, by Rasmussen (Viertel-jahrsschr. für Dermatologie und Syphilis, Bd. viii. S. 517), of which an abstract may be found in the Philadelphia Medical Times, March 26, 1881.

[3] La France Médicale, t. i. p. 38; abstract in Archives of Dermatology, July, 1881, p. 334.

the rarity of the vaginal chancre.   Binet describes the lesion in one case as
situated on the right vaginal wall, near the inferior extremity of the os uteri;
a centimetre in diameter; the floor red, smooth, shining, and non-purulent;
the edges slightly elevated and passing without a ridge into the bottom of
the erosion.   Induration was difficult to make out from the peculiar situa-
tion of the chancre, but by passing the finger lightly over the tissues in the
neighborhood, a slight resistance could be perceived as of a more resilient sur-
face.   The lymphatics running along the walls of the vagina were enlarged,
and appeared to leave the erosion and run toward the indurated post-pubic
ganglia.   Small ganglia could also be perceived in the neighborhood of the
obturator foramen.   In Binet's other case, the chancre was situated on the
posterior wall of the vagina just within the carunculæ myrtiformes.   It was
about two centimetres in diameter, and presented the same features as the
lesion in the first case.

Extra-Genital Chancres.

Extra-genital chancres occur in men in the proportion of 6 per cent. of
chancres of all kinds.   In women, the proportion of extra-genital chancres
is much greater, amounting to 16 per cent., an important clinical fact.   The
usual seat of extra-genital chancre is about the mouth in both sexes, and,
in women, about the anus and on the breasts.   The chancres of other extra-
genital localities are much less frequent.

The following statistics,[1] compiled from various sources, show the comparative fre-
quency of the different extra-genital chancres in men and in women.

Men.		Women.	
Anus	12	Anus and perineal region . .	21
Lips	36	Lips	20
Gums	1	Tongue	2
Tongue	8	Uvula	2
Nose and cheek . . .	3	Mouth (in general) . . .	4
Eyelids	2	Breasts	11
Abdomen	9	Groin and thigh . . .	8
Buttock	1	Buttocks	4
Lower limbs	3	Ala nasi	6
Fingers	2	Forehead	3
	—	Neck	1
	77		—
			82

Buccal Chancres.—Among chancres of the *buccal region* those of the *lips* are
the most common.   Chancre of the lip may be a very minute and insignificant
lesion.   It may also be a more extensive ulcer, raised, crusted, and involving
the skin beyond the muco-cutaneous surface of the lip, being accompanied by
very considerable œdematous swelling and firm infiltration of a characteristic
sort, usually insensitive, but sometimes giving pain from tension, and not
infrequently causing so much eversion of the lip as to prevent the mouth from
being closed (Plate IX. Fig. 4).   Chancre of the lip may also be a fissured
ulceration, springing from a cracked lip, and unfortunately too apt to be mis-
taken for this trifling lesion.   When chancre occurs on the inner surface of
the lip, the ulcer is less elevated than in chancre of the outer aspect, and is
occasionally accompanied by perceptible loss of substance.   The submaxillary
glands become swollen in about ten days after the appearance of the chancre,
and often give rise to much pain and discomfort.   In infants, buccal chancres
are usually derived from mucous patches on the nurse's nipple.

¹ Jullien, op. cit., p. 533.

Chancres are also met with on the *gums*, the *gingivo-labial surface of the tongue*, the *velum palati*, the *tonsils*, and the *pharynx*, the sore in each locality presenting certain characteristic features. Chancre of the *tongue* is usually situated on the top of this organ, and presents a peculiar opaline surface, which may cause it to be mistaken for a mucous patch. Chancre of the tongue may become phagedænic and be transformed into a large ulcer. One such case has been cited by Jullien. Chancre of the *tonsil* is very rare, and its existence even has been disputed. The lesions, as described, are never sharply defined. They are dark-red, superficially ulcerated nodules, which secrete a scanty fluid. The history of the case, the subacute course of the nodules, the absence of inflammatory symptoms, and the enlargement of the cervical and submaxillary ganglia, would be the points upon which to rely in arriving at a diagnosis. Phagedæna is a rare complication of the buccal chancre wherever found.

ANAL AND RECTAL CHANCRE.—Chancre of the *anus* is much commoner among women than among men. In the former, it is probably, as a general thing, communicated by accidental contact in normal sexual intercourse, while in men the existence of chancre of the anus gives just cause for suspicion of unnatural abuse, though it is possible that it may be contracted by contact with the finger, etc. French statistics show that in men 1 chancre in 119 is anal, while in women 1 in 12 is seated in this locality. Statistics are wanting for this country, but my impression is that anal chancre among men is of the rarest. The usual seat of anal chancre is in the folds of the anal mucous membrane. These being put upon the stretch, the lesion may be discovered in the form of an elongated reddish ulcer. Occasionally, however, the chancre is minimal in size, a small, excoriated papule. Now and then it is large, cup-shaped, and excavated, with a well-marked, indurated base. Intra-anal chancre is generally of the fissured form. *Rectal chancre* is very rare, and can scarcely occur except as the result of unnatural intercourse. Anal chancre is usually indolent, very rarely exciting reflex spasm. This is a very important diagnostic sign, since simple fissures are usually accompanied by severe pain. In the lowest classes of women the anal chancre is sometimes " mixed." A not very infrequent complication is that of vegetations, which sometimes occur to a quite considerable size. Stricture of the rectum is rarely, if ever, the result of chancre. So-called chancral strictures are usually due to gummatous or other late syphilitic lesions. Indurated engorgement of the external inguinal glands is a usual accompaniment of anal chancre ; it appears early, and is usually bi-lateral.

CHANCRE OF THE MAMMARY REGION.—Chancre of the breast is one of the most important among extra-genital chancres. Although it may be contracted by contact with the mouth or even the genitals of another adult, it is by far the most frequently met with as the result of contagion from mucous patches on the lips of nursing infants.[1] This fact is of importance from a medico-legal point of view, and the characteristics of this lesion should therefore be borne in mind.

When seated outside of the nipple, mammary chancre can be diagnosticated without difficulty. It shows itself as an erosion, or an eroded papule of some size, with or without a crust, roundish or ovalish, and resting upon an indurated base (Plate IX. Fig. 6). When, however, mammary chancre affects

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[1] According to " Colles's law," which will be explained on a subsequent page in treating of the hereditary transmission of syphilis, the mother of an infant the subject of hereditary syphilis cannot contract the disease from her offspring.

the nipple, and especially when it is confined to the base of the nipple, it is sometimes difficult of diagnosis. Irregular in form, often very small, even like a slight fissure at times, and masked by a crust, it is very apt to be mistaken for some simple lesion, such as a chapped breast, a furuncle, or a simple erosion, a circumscribed eczema, or a bite or some other injury contracted in nursing. It should be remembered that mammary chancre is at times one of the slightest and apparently most inoffensive of lesions. Two symptoms, however, may usually be relied upon to decide the diagnosis, or at least to aid it materially. The first of these is the induration of the lesion, characteristic of chancre, and wanting in the other lesions liable to be mistaken for it. The second is the enlargement of the axillary glands, which is never wanting, and which presents the peculiarities of syphilitic adenopathy—the cold, hard, indolent condition. The indolent and comparatively painless character of the lesion is also of importance from a diagnostic point of view. When the patient suffering from supposed mammary chancre is a nursing woman, she should of course be confronted with the nursling, and a careful examination should be made of the latter, with the view of ascertaining the presence or absence of signs of syphilis.

DIGITAL CHANCRES.—A few words may be said with reference to chancre of the finger, which, though rare, yet does occur from time to time, and may go unrecognized to the injury of the patient, and to the danger of those with whom he may be brought into contact. The type of chancre of the finger commonly met with is the "ulcus elevatum." Its evolution seems to be somewhat slower than that of chancre of the genitalia, the induration in particular lasting a long time. The commonest seat of chancre of the finger is at the side or base of the nail, or at its free margin. It begins as a papule, pustule, slight excoriation, or fissure. On examination, a deep-red, hard, elevated mass of moderate size is perceived, which when ulcerated yields a scanty, serous secretion. The borders of the nail may be thickened or superficially ulcerated, but the sore is confined to the soft parts—a point of distinction between chancre and syphilitic onychia. The entire distal phalanx is sometimes indurated, giving the finger a bulbous shape. The epitrochlear and axillary ganglia are usually enlarged, and moderate lymphangeitis is sometimes present. Physicians and midwives are more apt than others to be affected with this form of chancre, and, especially in the case of midwives, the affection may be conveyed to others and very widely spread.[1]

RELATIVE FREQUENCY OF CHANCRE AND CHANCROID.

The relative frequency of chancre and chancroid is a matter demanding some notice. According to Belhomme and Martin,[2] the French statistics on this subject are so diverse that it is impossible to draw an average, one observer reporting four chancroids to one chancre, while another meets with them in nearly equal numbers, and while others, especially of late years, find the proportion nearly reversed. (See Tables, pages 439, 440.) One thing is certain, namely, that among the upper classes chancre followed by syphilis is the commoner affection, while in the lower classes chancroid is more frequently met with. In all probability chancroid is destined to greater rarity as time goes on, and it is not rash to hope for its almost entire extinction in the not very remote future.[3]

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[1] See Bardinet, Syphilis communiquée par le doigt d'une sage femme. Bulletin de l'Académie de Médecine, Avril, 1874.

[2] Op. cit., p. 12.

[3] See Bumstead and Taylor, op. cit., p. 346.

Lesions occurring Concomitantly with Chancre.

LYMPHANGEITIS.—In one case out of five, according to Bassereau, the chancre is followed by inflammation of one or more lymphatic vessels in its neighborhood. These appear in the form of cordy indurations under the skin, more or less straight, or occasionally wavy and moniliform. Sometimes several parallel lymphatics are involved, giving the sensation of a ribband under the skin. It is only rarely, and when the inflammation is more severe, that the enlarged lymphatics can be traced by their color, which shows of a light red under the skin. This engorgement of the lymphatics is unaccompanied by fever, and patients sometimes fail to notice the change. At other times there is a slight sensation of weight and tension.

After three or four weeks, the lymphangeitis commonly disappears by resolution. Occasionally, however, like the induration of the chancre itself, this induration may last for six or eight months. In rare cases an abscess, followed by a lymphatic fistula, exuding a clear fluid, occurs in the course of the vessels. This often is healed only with difficulty. The richness of the genital region in lymphatics makes the occurrence of angeioleucitis much more common in chancres of these parts than it is in connection with extra-genital chancres. In men, the lymphatics of the dorsum penis are those most usually affected, and their long cord-like course can easily be followed to the pubes and to the groin. In women, the inflamed lymphatics are hidden in the tissues of the labia minora and majora, and run up toward the ganglia parallel to the genito-crural fold. They are also met with about the mons veneris in the form of knotty masses buried in the fatty tissues of the region. When they cannot be perceived by the touch, the presence of inflamed lymphatics in this region is often manifested by œdema of the mucous or muco-cutaneous surface of the vulva.

ADENITIS.—Adenitis is in reality not a complication of chancre, but a necessary accompaniment. It occurs almost invariably; as Ricord used to say, "The bubo follows the chancre as the shadow follows the person."[1] Adenitis is, if not the most, at least one of the most important aids to the diagnosis of chancre, and its peculiar characteristics should be carefully noted.

The bubo symptomatic of chancre is found in the ganglia with which the lymphatics of the affected region are connected. If the chancre is seated on the genitalia, the glands of the groin are affected, but those of other regions, the submaxillary, for instance, remain unaffected. If the chancre is in the mouth, the submaxillary glands are enlarged, but those of the groin remain intact.

The following table, from Fournier, shows the seat of the bubo corresponding to chancres of various localities.

SEAT OF CHANCRE.	CORRESPONDING BUBO.
Genital chancres, that is, chancres of the penis, scrotum, labia majora and minora, fourchette, meatus urinarius, urethra, opening of the vagina, etc.	Inguinal ganglia.
Perigenital chancres : chancres of the perineum, genito-crural region, mons veneris, buttocks, thighs, etc.	Inguinal ganglia.

[1] Fournier, in 265 cases of chancre occurring in men, found adenitis in 263 ; in 223 cases of chancre observed in women, 220 showed concomitant adenitis.

SEAT OF CHANCRE.	CORRESPONDING BUBO.
Chancres of the anus and margin of the anus.	Inguinal ganglia.
Chancres of the lip and chin.	Submaxillary ganglia.
Chancres of the tongue.	Subhyoid ganglia.
Chancres of the eyelid.	Pre-auricular ganglion.
Chancres of the finger.	Epitrochlear ganglion ; **axillary ganglia.**
Chancres of the arm.	Axillary ganglia.
Chancres of the breast.	Axillary and sometimes subpectoral ganglia.
Chancres of the cervix uteri.	Theoretically the pelvic ganglia ; in general, no engorgement in the groins ; exceptionally, inguinal bubo.

The induration of the ganglia begins about the same time as the induration of the base of the chancre. In rare cases the induration may be delayed, but, according to Ricord, never longer than a fortnight. Fournier, however, mentions one case where the ganglionic induration did not appear until twenty-seven days after the appearance of the chancre.

In adenitis accompanying chancre of the genitalia, the induration may affect the glands of either or both groins. It usually occurs on the same side as that upon which the chancre is situated. One or more glands may be affected. The " pleiad" of olive-shaped or globular tumors is felt, cartilaginous in hardness, freely movable on each other and the surrounding tissues, and without attachment to the overlying integument. One gland is usually more developed than the rest, and may be of almond size, while the others as large as a bean or a cherry surround it like satellites.

A marked peculiarity of the syphilitic adenitis accompanying chancre is its indolent character. The glandular enlargement takes place insidiously, often without the patient's knowledge. The skin remains unaltered, there is no pain, and only slight tenderness on pressure. The whole picture of " syphilitic bubo" is as widely different from that of chancroidal bubo as it is possible to imagine. (See article on Chancroid, page 435.) Less frequently a single tumor is felt in the groin, and this may be somewhat larger than those above described. The various characteristics, however, remain the same.

Ganglionic induration is usually at its height within a week or two weeks. If mercury be given, it may diminish in degree, only to return when secondary or general symptoms show themselves. It may last from several weeks to five or six months, or longer. The adenitis of syphilis very rarely results in suppuration. Bassereau found only 16 cases of suppurating bubo in 383 cases of syphilis, while Fournier found but 2 in 265.

The importance of the non-suppurative character of syphilitic bubo, is seen in the investigation of cases where doubtful lesions, late in character, if syphilitic, show themselves. If the patient gives a history of venereal sores accompanied by non-suppurating buboes, syphilis may with great probability be inferred. If, on the other hand, the venereal sores were followed by suppurating buboes, the probability, though much less strong, is in favor of the occurrence of chancroid. It is a common but not invariable rule that syphilis does not follow an open bubo.

Syphilitic adenitis is most apt to be confounded with strumous engorgement. The history of the case and the accompanying symptoms must decide the diagnosis. From simple inflammatory and virulent bubo, the indolent and non-inflammatory character of the lesion under consideration will distinguish it.[1]

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[1] See Auspitz, Buboes of the Inguinal Region. Archiv für Dermatologie und Syphilis, 1873. Translated in the American Journal of Syphilography and Dermatology, vol. v, 1874, pp. 131, 270.

Diagnosis of Chancre.

The diagnosis of chancre is sometimes easy, and at other times very difficult, but it is always a matter of great importance, both on account of the prognosis, and also on account of the treatment which is to be followed.

One of the first questions that suggests itself here is at what date can a positive diagnosis be reached. Patients not infrequently apply to the physician with an abrasion of recent date, perhaps not twenty-four hours old, demanding a categorical answer to the inquiry what may be the nature of the lesion. The answer to this can be of but one kind. It is impossible to say, at so early a date, what such a lesion may turn out to be. The most virulent chancre, leading to the most malignant form of general syphilis, is, in the earlier days of its appearance, one of the most benign of all lesions. A pinscratch looks more threatening. In fact, where a mistake in diagnosis has been made, it has been, nine times out of ten, that the chancre has been mistaken for an abrasion. This fact should be kept in mind as giving a good notion of the ordinary appearance of a chancre when it first makes its appearance. It is not an ulcer; not a sore; it is an abrasion, or a scratch, to all appearance.

A little later, when the chancre has begun to differentiate itself from lesions of similar appearance, two diagnostic points of much value present themselves. These are *induration* and *glandular engorgement*. All other diagnostic signs are delusive. The contour of the lesion, its form, its color, the aspect of its surface, etc., are variable, inconstant, and not to be trusted. But palpation of the base of the suspected lesion will almost invariably reveal a peculiar resistance, a hardening of the tissues, which, when present, is an almost certain sign of chancre. No other lesion likely to be mistaken for chancre presents this firmness of base, though when caustics or irritants have been used, there is often developed an inflammatory induration which is with difficulty distinguished from the induration of chancre.[1] Again, if the suspected lesion is of some standing, at least one to two weeks, the presence of glanglionic engorgement, that is, of a group of small, bullet-like, indolently swollen glands in the groin, will indicate almost with certainty that it is a chancre.

Next to a simple abrasion or scratch, the lesion which is most likely to be mistaken for chancre, and *vice versâ*, is herpes progenitalis. It is indeed often very difficult to distinguish between the two lesions. One of the first diagnostic signs is that herpes is almost always accompanied at its first appearance by heat or burning of a local character, while chancre is completely indolent and without sensation. This sign, though of value, depends upon the subjective sensations of the patient, and cannot, therefore, be entirely depended upon in many cases. More certain diagnostic signs are the condition of the ganglia, the presence or absence of induration, and the *outline of the lesion.* As to the ganglionic engorgement, this is not present where there are only one or two scattered lesions of herpes, but where the herpetic lesions are confluent and of some size, there is a ganglionic engorgement, differing from that of chancre, however, in being merely a slight sub-inflammatory tenseness of the ganglia. The induration of chancre is marked; that of herpes, in the unusual circumstance of its being present, is nothing more than a very slight inflammatory firmness of the underlying tissues. The outline of the lesion is strongly insisted upon by Fournier as one of the most satis-

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[1] In investigating a suspected sore, the question should always be asked : " Has any application been made ?"

factory and certain diagnostic differences between herpes and chancre. The contour of a chancre is represented either by a circle of a certain diameter, more or less; by an oval figure; or by an irregular geometrical outline. The contour of a large patch of herpes on the other hand is of a curiously figurate character, made up of a series of incomplete circles (Fig. 329). This

Fig. 329.

Outlines of chancre and herpes, showing polycyclic contour of herpetic lesions; *a*, chancre; *b*, herpes.

"polycyclic" form, as Fournier calls it, is not accidental; it results from the fusion of a number of independent circular lesions, and is pathognomonic of herpes. Of course chancre does not possess this peculiarity because it is not made up in the same manner.

To these diagnostic signs between herpes and chancre, which are to be depended upon when a conclusion is to be reached if possible at the first view, may be added another which requires time, I mean the ulterior evolution of the lesion, which is of course the criterion *par excellence*. If the lesion is herpes, repair quickly takes place, and rapid cicatrization, with no after symptoms. If, on the other hand, it is a chancre, the process of repair is in most cases a slower one. The lesion extends a little, or more frequently remains stationary as regards size, meanwhile assuming a more and more characteristic appearance, and the accompanying ganglionic enlargement shows itself unequivocally. Of course, all uncertainty is at an end when, after a few weeks, generalized symptoms make their appearance.

One cause of possible error must be alluded to at this point: it is the fortuitous coexistence of herpes and chancre in an identical locality. This is not as rare as might be supposed; in fact, Fournier says it is not uncommon in women. It may occur through the inoculation of the syphilitic virus upon an herpetic ulcer, or, on the other hand, an outbreak of herpes is sometimes induced as a result of the irritation of a chancre, and in its immediate neighborhood.

In the female, chancre may occasionally be confounded with erosive vulvitis, especially as this occurs in infants and young children.[1] Ordinarily the diffuse and superficial character of the vulvitis is sufficient to distinguish it from that circumscribed form which sometimes shows itself around a chancre. Now and then, however, instead of showing itself in the form of confluent and desquamative erosions, this form of vulvitis displays discrete and somewhat excavated lesions, of a bright red color or of a pultaceous gray aspect, and in these cases the affection resembles chancre so closely that it is almost impossible to distinguish the two affections at first sight. The importance of this, in a medico-legal point of view, in the case of infants and young children said to have been the subjects of criminal assault, is of course very great. Fournier says that in medico-legal cases he makes it an invari-

[1] See Gougenheim, Des Folliculites Vulvaires Externes. Ann. de Derm. et de Syph., 2me sér., t. iii., Avril, 1880.

able rule, "never to diagnosticate chancre by the chancre," that is, never to found his diagnosis upon the appearance of the lesion itself.

Fournier[1] gives the following illustrative case :—A little girl, six years of age, was brought to the hospital as being the subject of chancres said to have been communicated in an attempt at criminal assault. Examination showed intense vulvitis, the labia majora being swollen to the size of a quarter of an orange, œdematous, red, and painful, with abundant suppuration. In addition, there was erosive intertrigo of the genito-crural folds, and of the upper and inner portions of the thighs and inguinal regions, and three ulcers also could be seen upon the labia majora. One of these was the size of an apricot pit, the other two were circular and the size of lentils. These lesions were of a grayish color and covered with a diphtheritic looking membrane ; they were shallow, with a flat surface, even a little raised in one lesion. They were indolent and had a somewhat indurated base. Finally, in both groins there were enlarged ganglia, indolent, multiple, and easily rolled under the finger.

With these lesions before him, Fournier unhesitatingly diagnosticated chancre with vulvitis, but, in accordance with his rule in medico-legal cases, declined to express his opinion formally to the court of justice until after a delay of a few days. Fortunately for the accused, this delay changed entirely the aspect of affairs. Within a few days, under a simple dressing, the vulvitis and ulcers disappeared like magic, the ganglia lost their induration, and the patient recovered without showing any subsequent signs of infection, though remaining under careful daily observation at the hospital for several months.

I have given the account of this case because it shows in the most striking manner possible how the most distinguished living syphilologist could be completely mistaken in a diagnosis at first sight. In making this ' confession" public, with characteristic candor, Fournier adds the following moral : (1.) The case demonstrates first, that certain simple, purely inflammatory lesions may take on the aspect—the mask and stamp, so to speak—of chancre, with such fidelity to the genuine lesion as to impose themselves upon the most attentive and experienced observer as the initial lesion of syphilis. (2.) It demonstrates, moreover, that the medico-legal diagnosis of chancre should not be made on a single examination of the lesion supposed to be such, but rather by the collation of confirmatory signs, of which the symptom first presented (chancre) should constitute the first term, and the secondary, generalized, constitutional symptoms following at a date named, should constitute the final term.

In considering the diagnosis of chancre thus far, the erosive and desquamative forms of the lesion have been kept in mind in connection with the other lesions with which these may be confounded. When, however, the chancre becomes more or less ulcerated (see Plate IX., Figs. 2 and 3), it is the chancroid with which it is most likely to be confused. The diagnosis between chancre and chancroid has been dealt with by Dr. Sturgis in the preceding Article (page 439), and I shall therefore not dwell upon this subject at length, but shall content myself with giving the following table, based upon those furnished by Belhomme and Martin and by Fournier, which shows in brief the various points to be considered in the differentiation of the two lesions, a task usually not very difficult.

DIFFERENTIAL DIAGNOSIS BETWEEN CHANCRE AND CHANCROID.

CHANCRE.	CHANCROID.
(1) Incubation on an average from fifteen to thirty-five days.	(1) No incubation.
(2) Derived from the contagion of a chancre, of a secreting secondary syphilitic lesion, or, in some cases, of the blood of a person suffering with secondary syphilis.	(2) Derived from the contagion of a chancroid or of a suppurating chancroidal bubo.

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[1] Op. cit., 2e éd., p. 203.

CHANCRE.

(3) Usually single, rarely multiple, never confluent.

(4) Non-inoculable on the patient.

(5) Begins by a simple erosion, or in some cases by a papule.

(6) When fully developed, the chancre is a superficial ulceration with sloping edges melting insensibly into the surrounding tissues, the centre covered in part with false membrane, the border bright red, usually of regular outline. Very little suppuration.

(7) Chancre is rarely painful.

(8) In ninety-eight cases out of one hundred, induration of the base is present; an elastic induration, gristly, having none of the characters of an inflammatory induration.

(9) The lymphatic ganglia in the neighborhood enlarge, harden, and become gristly, without suppuration. The lymphatic vessels also become indurated at times.

(10) Chancre is a lesion which gives rise to very little local reaction; it tends to spontaneous cure; it ulcerates only slightly; it rarely takes on phagedæna or gangrene; it follows a regular course.

CHANCROID.

(3) Almost always multiple, often confluent.

(4) May be inoculated any number of times on the patient. The pus of the suppurating bubo is also inoculable.

(5) Begins by a vesico-pustule.

(6) When fully developed, the chancroid is a somewhat deep ulcer, of which the base is covered with a sort of organic detritus mixed with pus. The edges are almost perpendicular, and sharply defined.

(7) Chancroid is almost always painful.

(8) Chancroid is often accompanied by inflammatory hardness, but never by syphilitic induration.

(9) Chancroid is often accompanied by adenitis or lymphangeitis of phlegmonous character, suppurating sometimes, and furnishing occasionally an inoculable pus.

(10) Chancroid is a rather serious local lesion; it has a strong tendency to ulceration; it follows a very irregular course, and does not tend to cure as chancre does. Phagedæna and gangrene are relatively frequent complications of chancroid.

Before leaving the subject of the diagnosis of chancre, attention must be called to a circumstance which may render this difficult or impossible at times, at least for a certain period, namely, the simultaneous occurrence of chancre and chancroid upon the same individual. Though uncommon, yet this does happen from time to time, much more frequently with women, however, than with men. A prostitute having connection with a number of men within a short space of time can easily contract a chancre from one and a chancroid from another, each running its course independently. Time and repeated observation will serve to differentiate the lesions in such cases.

With regard to the peculiar diagnostic points characteristic of the chancre in certain localities, as the urethra, breast, vagina, and cervix uteri, reference may be made to the account given of these lesions under the general description of chancre.[1]

PROGNOSIS OF CHANCRE.—Regarded as a local manifestation, chancre is ordinarily not a serious lesion. In some cases, however, either owing to its location, or because of some complication, a very unusual circumstance, this lesion may affect the anatomical structure, or may interfere with the functions, of some organ, and may thus influence indirectly the general health. Thus phagedæna may give rise to mutilation of the glans, or to urethral fistula, in men; to loss of the clitoris, or to destruction of more or less of the labia, in women; and to rectal stricture in either sex. Somewhat commoner

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[1] See also Ch. Mauriac, Diagnostic du Chancre Syphilitique. Ann. de Derm. et de Syph., n. s., t. i., p. 738.

than these complications, however, and quite serious, are the interference with nutrition which may result from buccal chancres, and the hemorrhage which may occur in phagedæna.

The difficulty in mastication and the pain caused by the passage of food, occurring particularly when the chancre is situated on the dorsum of the tongue, together, possibly, with the ingestion of septic discharges from the ulcerated surface, sometimes induce voluntary abstinence on the part of patients. As a result of this, gastric and anæmic disturbances may eventuate, dangerous not merely in themselves, but as diminishing the resistance of the organism to the assaults of the constitutional infection.

As to hemorrhage, Ory[1] cites the case of a young girl who had a chancre of the upper lip, which became phagedænic and destroyed a considerable portion of the lip. Hemorrhage occurred repeatedly from the affected part, so that the patient became exsanguinous, and fell fainting on the least exertion. Her life was preserved only by the most assiduous care, and convalescence was extremely slow.

The question whether the benignity or malignity of an attack of syphilis depends upon the quality of the infective material in any given case, or upon the nature of the soil in which the seed has been sown, has often been discussed. The first view, that of varying malignity in different virus, has one apparent fact in its favor—that is, the gradual diminution in the severity of syphilis since its first malignant epidemic occurrence in the fifteenth and sixteenth centuries. Syphilis at the present day is, in its earlier periods at least, a much milder disease than in former times. It has been asserted that this is due to the gradual attenuation of the poison in its transmission from generation to generation; but I think it is quite as likely that improved hygiene and therapeutics have played the most important part in ameliorating the severity of the disease. Even at the present day, moreover, there are certain parts of the world, as Mexico and China, where malignant syphilis still shows itself.

The other view, namely, that the severity of the disease in any given case depends upon the soil in which it is planted—that is, the constitution of the patient as influenced by hereditary or acquired infirmities of one kind or another, and by hygienic surroundings—has more clinical testimony in its favor.

Jullien cites the case of a young woman who was contaminated by her husband just after confinement. The latter was suffering from a very slight attack of syphilis. The unfortunate wife, however, fared far otherwise. After an unusually short incubation, fifteen days, a chancre appeared which destroyed a large part of the vulva; and towards the third month, in spite of energetic treatment, gummatous tumors appeared in various places. In less than a year the face had been destroyed by supervening phagedænic ulcerations. Other cases might be cited, going to show that the severity of the disease depends upon the elaboration which the virus undergoes under the influence of the organism in which it has been implanted.

The period of incubation is to some extent an index of the probable gravity of the affection in any given case. The less resistance the organism offers, the quicker the entrance of the virus—the briefer, in consequence, the period of incubation, and usually, also, the more malignant the subsequent symptoms. The character of the initial lesion, the chancre itself, is by many authorities regarded as indicative of the probable future course of the disease. Benign chancres, it is said, are followed by benign eruptions, and by non-suppurative lesions of the various tissues; phagedænic chancres by severe pustular syphilodermata and ulcerations, and, at a later period, by exostoses, necrosis, and caries.

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[1] In his Thesis, L'Étiologie des Syphilides Malignes Précoces. Paris, 1876.

I do not think that this can be rightly formulated as a law; there are too many exceptions. I have again and again observed severe syphilitic manifestations to follow the most benign and insignificant-looking chancres.

Among the various circumstances which may be mentioned as influencing the evolution of syphilis, the scrofulous or lymphatic temperament is perhaps one of the most important. "Dread syphilis occurring in blondes," says Diday. Old age, abuse of alcohol, debility from constitutional infirmity or from irregularity of life, pregnancy,[1] and mal-hygiene, are all elements of value in the prognosis of chancre.[2]

TREATMENT OF CHANCRE.—The abortive treatment of chancre—that is, its destruction with the view of preventing the subsequent development of general symptoms—has been discussed by syphilographers for many years without an unanimous opinion having been reached as to the desirability or the success of this procedure. At a time when the distinction between chancre and chancroid had not been clearly made out, such observers as Hunter and Ricord asserted that if the chancre were thoroughly cauterized before the fourth day after contagion, no constitutional symptoms would follow. But chancre does not make its appearance before the third week as a general thing, and almost never before the tenth day. Consequently, those chancres which were aborted on or before the fourth day after contagion, were not chancres at all, but something else—chancroids, herpes, etc. More recently several observers, among them Auspitz[3] and Kölliker,[4] have extirpated chancres by the knife; but when carefully analyzed, and the doubtful cases rejected, their statistics do not offer satisfactory evidence in favor of this form of the abortive treatment. They have failed to bring forward conclusive evidence, in connection with their successful cases, that constitutional syphilis would have appeared if extirpation had not been practised.[5]

With regard to the cauterization or extirpation of a chancre considered as a local lesion, I think that this should not be performed, unless when phagedæna is present. The lesion ordinarily tends to get well spontaneously, and irritative or too stimulating applications are apt only to arouse irritation, and to give trouble in the future. The simplest dressing is therefore the best.

Continence should always be urged upon the bearer of a chancre, whether male or female; not only to avoid the irritation resultant from coitus, but also, and still more, to prevent conveyance of contagion. Many men, when they have contracted a chancre, care but little whether they transmit it to others or not. Women also, with whom chancre is usually such a minimal lesion, often think that they are unlikely to convey disease by means of such a trifling sore, and thus the affection is spread. In advising such persons, it is as well, in view of the selfishness of human nature, to lay stress upon the possible injury which patients may inflict upon themselves, by indulging in sexual intercourse while bearing a chancre upon their genitals, rather than upon the harm which they may inflict upon others.

A strict regimen, including abstinence from wine or liquors, and in some instances from tobacco, should be followed out during the course of treatment.

[1] See Cernatesco, De la Marche et de la Durée du Chancre Syphilitique et des Syphilides Vulvaires pendent le cours de la Gestation. Paris, 1878.

[2] See Ch. Mauriac, Prognostic et Traitement de la Syphilis Primitive. Abstract in Ann. de Derm. et de Syph., n. s., t. i., p. 295; from La France Médicale.

[3] Vierteljahrsschr. f. Derm. u. Syph., iv. 1877, 1 und 2, S. 101.

[4] Centralblatt f. Chirurgie, Nov. 30, 1878, S. 801.

[5] Among recent writers on this subject are Chadzynski, "Sur la valeur prophylactique de l'Excision de la Sclérose Syphilitique Initiale." Ann. de Derm. et de Syph., n. s., t. i., p. 461; also, Primo Ferrari and Francesco Folinea, of whose papers Jullien has furnished abstracts in the same journal, p. 362.

Locally, the most scrupulous cleanliness must be observed, especially if the chancre is so situated as to be soiled by the excretions, as in the anus or vulva. Frequent warm baths are beneficial, especially if there is any tendency to irritation. The affected part should be protected from contact or rubbing with the neighboring parts, or with the clothing. In reality this is, in the majority of cases, all that is required. When the patient demands more active treatment, dilute solution of chlorinated soda, black wash, or some mild astringent powder, such as that of the oxide of zinc, may be prescribed. The fact is that in the majority of cases the chancre tends to a spontaneous cure, and only requires to be let alone in order to get well of itself. When the chancre is slightly painful, rest is to be prescribed, with frequent warm baths and sedative lotions, such as lead-water and laudanum; or the following ointment may be used, remembering that an ointment cannot conveniently be applied to a mucous surface, or in the balano-preputial fold :—

> ℞.—Ung. hydrarg. ℨv.
> Ung. aquæ rosæ, ℨij.
> Tinct. opii, ♏ vj.   M.

It would seem scarcely necessary to advise against the employment of stimulating or irritating remedies, did not experience show that these are daily employed by practitioners in the treatment of chancre. Touching with the nitrate-of-silver stick, or cauterizations with sulphate of copper, etc., are of no use, and are frequently harmful. Cauterization is only justifiable under two conditions: either to stimulate the surface of the chancre when this is sluggish, or tends to remain covered with a pseudo-membranous coating—when the nitrate-of-silver stick may be applied lightly at intervals of several days; or to repress exuberant granulations appearing during the process of repair.

Sometimes, after the chancre has healed, there remains behind an indurated lump, which is slow to disappear. The expectant treatment alone is proper in such a condition. Patients are frequently anxious for something to be done to hasten the removal of what is sometimes a deformity, and will urge the employment of stimulant applications, caustics, or even the knife. Interference, however, is not proper, as the result will probably prove very unsatisfactory. Fournier relates the case of a young man who had a chancre on the frænum of the prepuce, followed by a walnut-sized induration. Notwithstanding the assurance of Ricord and Fournier that it would disappear spontaneously in time, the patient induced some ignorant or unscrupulous practitioner to excise the lump. Violent hemorrhage followed, only checked by the actual cautery. Afterwards, *a larger lump than the preceding one* gradually took its place, and the patient only recovered after some months with the loss of a good part of his glans penis, all on account of a lesion which, let alone, would have disappeared without leaving a trace !

PERIOD OF THE GENERALIZED LESIONS OF SYPHILIS.

The various stages in the evolution of syphilis were formerly, and are still frequently, classified under three heads, primary, secondary, and tertiary. But, while the first two of these are distinctly separate, and divided the one from the other, it is not thus with the so-called secondary and tertiary periods, which possess no distinct line of demarcation in practice. I prefer therefore to consider all the lesions of syphilis following the chancre and its concomitants, under the comprehensive category of *generalized lesions*. For

the poison which has heretofore been confined, as to its outward manifestations, to a single locality and its immediate neighborhood, now diffuses and spreads itself about throughout the economy, and shows itself in the form of constitutional symptoms of various nature.

The term "constitutional syphilis" has sometimes been employed to designate the period under consideration, but I consider this term faulty, as implying a local character for the chancre, which indeed is as much a "constitutional" symptom as any that follow.

A further division of the generalized lesions into *early* and *late* may be made for convenience's sake, it being understood that this subdivision is not and cannot be accurate, the chronology of the various symptoms not being the same in every case, although their sequence is never inverted. For example, the erythematous, pustular, and gummatous syphilodermata occur in this order, and usually with certain intervals of time between the appearance of each. But, while in certain cases where the syphilitic attack tends to assume a malignant type, these eruptions follow one another in such rapid succession as to appear almost synchronously, yet they never appear in inverted order, and we never see a gummatous tumor followed by an erythematous syphiloderm.

GENERAL CONDITION BEFORE AND DURING THE OUTBREAK OF THE EARLY GENERALIZED SYMPTOMS.—The chancre, as has been said, is, for a time, the only manifestation which betrays the existence of syphilis. For a certain period, no other lesions show themselves to indicate that a virus is lurking in the system. This period of the "second incubation," as it is called by some authors, the second interlude in the drama of the evolution of syphilis, as Fournier graphically terms it, is followed by the explosion of generalized symptoms. Its duration is on an average forty-five to fifty days, although it may vary, in exceptional cases, as much as a week or ten days on either side of these figures.[1]

Following this period of apparent repose, the generalized symptoms make their appearance in due chronological sequence, never appearing before the chancre, never appearing without the chancre having first appeared. There is no such thing as *syphilis d'emblée*, the sudden outbreak of generalized symptoms; a chancre, whether detected by the patient and physician, or whether eluding the closest scrutiny, has certainly, and of necessity, preceded any general outbreak.

CONDITION OF THE BLOOD IN SYPHILIS.—That the blood must undergo some change during the evolution of the syphilitic poison in the economy, has long been admitted, but the first scientific observations upon the subject were made by Grassi, under the direction of Ricord.[2] Grassi undertook a number of chemical analyses of the blood in persons suffering from venereal sores, and found that when these sores were not followed by subsequent syphilitic manifestations (chancroid), the blood remained normal ; while in cases where subsequent generalized symptoms resulted (chancre), the blood showed diminution of the globular mass with proportional increase of the albuminous constituents. Grassi's results were confirmed by Wilbouchewitch, of Moscow,[3] who, desiring to study the influence of mercury on the composition of the blood,

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[1] Of course this refers to untreated cases. Mercury given during the early stages of the disease retards the evolution of symptoms. In rare cases the second incubation may be longer ; Keyes says as long as four or five months. (Op. cit., p. 101.)

[2] Leçons sur le Chancre, 2e éd., p. 184.

[3] De l'influence des préparations mercurielles sur la richesse du sang en globules rouges et en globules blancs. Archives de Physiologie, pp. 509, 537, 1874.

commenced by inquiring into its condition before the administration of the drug, and during the existence of chancre.

In ten cases studied by Wilbouchewitch, the average diminution of red corpuscles was 638,870 (the normal figures being taken as from 4,200,000 to 6,477,000), while the increase in the white corpuscles was 550, the proportion being 1 white corpuscle to 448 red corpuscles, instead of 1 white to 530 red, the average normal proportion.

Of course this impoverished condition of the blood would be likely to lead to various characteristic symptoms, and thus we find in some cases disorders of circulation, irregularity in the action of the heart, murmurs in the larger vessels, pallor, epistaxis, and occasionally œdema of the lower extremities. In addition, general malaise, loss of energy, and a constant sense of fatigue; nervous symptoms, such as vertigo, insomnia, and headache, particularly of a temporo-frontal character; also vague and diffuse pains of various sorts—sometimes in the muscles, giving rise to simulated torticollis, pleurodynia, or lumbago—at other times concentrated in the joints or in the shafts of the long bones; in a word, any or all of the symptoms of an anæmic condition.

While these symptoms of anæmia are not well marked in every case of early syphilis, yet one or another is almost always present in cases of average severity.

Syphilitic Fever.—There are few cases of syphilis which, if closely watched, will not show some febrile movement, and occasionally the fever plays a prominent part in the history of the case. It is sometimes the chief symptom which the patient recalls subsequently, when examined as to the early history of the disease. The fever of syphilis commonly makes its appearance from the fiftieth to the sixty-fifth day after contagion, perhaps on an average in from the third to the fifth week after the appearance of the chancre. Its outbreak is usually preceded by one or two days of headache and prostration, followed by a more or less violent chill. The temperature commonly varies from 100.4° to 102.2° F., but in some rare cases it may reach 104°, 104.9°, and even 105.4°. (Fournier indeed reports a case where the temperature reached 107°.)

Courteaux[1] describes three distinct varieties of syphilitic fever, as follows:—

(1) The *intermittent form*, comprising a series of isolated attacks with intervals of complete apyrexia, is the most common. These attacks resemble very closely those of malarial intermittent fever. They usually begin in the evening, and last about twelve hours, occasionally assuming a quotidian type, but more frequently following an irregular course. Although following the usual routine of chill, fever, and sweating, they do this in a less complete and less regular manner than is the case in malarial intermittent, the stages of chill and sweating being scarcely perceptible, and, in fact, rarely being noticed by patients, who complain of the fever only. What is commonly observed is continuous fever, broken transitorily by intermittent chills, the sweats also occurring from time to time during the attacks of fever. The spleen is not enlarged. *This form of syphilitic fever yields readily to the influence of mercury, but is entirely uninfluenced by quinine.*

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[1] Thèse de Paris, 1871, written under the inspiration of Fournier. (Annales de Dermatologie et de Syphiligraphie, t. iii., p. 213.) In addition, reference may be made to the writings of Guntz (Das syphilitische Fieber. Leipsic, 1873); Bremer (Nordiskt med. Ark., 1874, and Gaz. Hebdomadaire, Mars, 1875); Vajda, Ueber das syphilitische Fieber und den Stoffwechsel syphilitischer (Vierteljahrsschr. f. Derm. u. Syph. 2te Jahrg., 1875, S. 147), and with annotations by R. W. Taylor (Archives of Dermatology, vol. iii., 1877, p. 162); and, finally, Fournier, op. cit., 2e éd., p. 643.

As the likelihood of mistaking malarial and syphilitic intermittent fever, one for the other, is very great, and as it is important to make the diagnosis when this is possible, I add the following table of comparative symptoms from Fournier :—[1]

SYPHILITIC INTERMITTENT FEVER.

(1) Almost always quotidian, not assuming the tertian or other forms.

(2) Almost always nocturnal.

(3) Attack generally incomplete, not comprising the three classical stages, the stages of chill and sweating being usually absent, and the feverish stage most prominent.

(4) Attacks almost always irregular, the stages being confused or inverted, and the symptoms of the various stages associated.

(5) Attacks very variable as to form and general character, differing in one case from another, or in the same case at different times.

(6) Attacks usually briefer in duration than those of malarial intermittent, and frequently very short.

(7) Never enlargement of the spleen.

(8) Attacks rebellious to the influence of quinine, but yield readily to mercury.

MALARIAL INTERMITTENT FEVER.

(1) Sometimes quotidian, but more frequently tertian, especially in well-marked forms and at the beginning.

(2) Usually diurnal.

(3) Attack generally complete, that is to say, composed of three successive stages, each one presenting characteristic symptoms.

(4) Attack methodical as to evolution, each stage being clearly defined, and the stages succeeding one another with perfect regularity.

(5) Attacks generally uniform, and similar in one case to another, or in the same case at different times.

(6) Attacks generally somewhat protracted.

(7) Almost invariably appreciable increase in the size of the spleen.

(8) Attacks yield to quinine, but uninfluenced by mercury.

(2) The *continued form* of syphilitic fever, with exacerbations, is usually accompanied by general asthenia, sometimes giving it very much the aspect of typhoid fever. In other cases the temperature (104° F. and over), frequency of the pulse, extreme flushing of the face, headache, rachialgia, and general prostration, cause the attack to resemble the prodromic fever of variola so closely that even when a chancre has been detected, the diagnosis must be suspended until the fourth day. When, as occasionally happens, the outbreak of the small pustular syphiloderm occurs in the midst of the fever, the diagnosis becomes extremely difficult; and I have in several cases seen experienced and able practitioners entirely at fault for a time. The records of our smallpox hospitals tell a similar story, supposed cases of variola being admitted now and then during a smallpox epidemic, only to show undoubted syphilitic symptoms a few days later.

An important diagnostic point may be mentioned in this connection, namely, the normal performance of the more important functions of the economy in spite of the intensity of the morbid process. Frequently, for example, the appetite is preserved, the tongue retains its normal color, and the stools are regular in patients whose pulse beats at a high febrile rate. Gamberini has noted the absence of thirst, and Vajda has observed that the urinary deposits do not at all indicate the degree of mal-assimilation which would naturally be looked for with an elevated temperature. In addition there are no pectoral *râles*, such as often occur in typhoid; no lachrymation, no conjunctivitis, no coryza, as in rubeola; no angina, as in scarlet fever; no profuse sweats, as in rheumatic fever.

(3) *The ambiguous form* of syphilitic fever is much less frequent than the

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[1] Op. cit., 2e éd., p. 656.

two former varieties. It is scarcely describable, passing and repassing from one form to another, from continuousness to intermittence, an intermittence capricious and indeterminate in character, and greatly prolonged.

Diagnosis of Syphilitic Fever.—The diagnosis between the intermittent type of syphilitic fever and malarial intermittent has already been dwelt upon. The continued forms of syphilitic fever may be mistaken for variola, as has been already said, and also for typhoid fever and rheumatism. The diagnosis from variola will be touched upon further in dealing with the papular and pustular syphilodermata, for it is only when these eruptions are present that the mistake is likely to be made. From typhoid fever, the absence of initial epistaxis, stupor of the countenance, intestinal disturbances (diarrhœa, gurgling in the iliac fossa, meteorism, etc.), buccal coating, bronchial *râles*, swelling of the spleen, rose-colored lenticular rash, etc., will distinguish syphilitic fever.

In a certain number of cases, where the syphilitic fever is accompanied by what Fournier calls " secondary pseudo-rheumatism," it simulates subacute rheumatic fever most closely, and the diagnosis can only be made after the most minute examination, bearing chiefly on the points of the correlative or independent occurrence of the febrile and articular symptoms ; if these latter are or are not developed in a rheumatic subject and under the influence of an existent rheumatism ; if they affect the characters of syphilitic joint-troubles[1] rather than those of common rheumatism ; if they coincide with some symptoms of the same order but more distinctly syphilitic (as, for example, periostitis, periostosis, tenosynovitis, etc.). With these various points in mind, the diagnosis can in many cases be arrived at with some degree of certainty. Nevertheless, cases will arise in which it is simply impossible to distinguish between syphilitic fever accompanied by rheumatismal manifestations and ordinary rheumatism, at least until some symptom arises which is beyond doubt distinctive.

Prognosis of Syphilitic Fever.—The intermittent form of syphilitic fever is a comparatively unimportant manifestation of the disease, but the continuous variety, particularly when it extends over a considerable period of time, may lead to more or less serious nutritive disturbance. Patients sometimes fall into a state of anæmia, languor, and general atony, from which it is difficult to arouse them. In women, who are much more prone than men to suffer with the severer forms of syphilitic fever, this condition sometimes exists to a marked degree. It may be added that the severe forms of continuous syphilitic fever are apt to be followed at a later period by grave visceral syphilitic lesions.

Treatment of Syphilitic Fever.—Mercury, alone or combined with iodide of potassium, is the only satisfactory medicine which can be administered in syphilitic fever. Quinine, arsenic, etc., are entirely without specific value. The influence of mercury is, however, not uniform in all the varieties ; while it is rapidly and certainly effective in the intermittent form, it is much less energetic and is slower in its action when given in the continuous variety. For this reason the dose should be double or triple that given in the inter-

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[1] Fournier points out the following peculiarities of syphilitic joint-troubles : There is less acute and less inflammatory articular effusion—often, indeed, this is minimal and insignificant (many cases of articular syphilis are nothing more than simple arthralgia, without tumefaction, redness, effusion, or appreciable lesion); the articular attacks are more invariable, not as shifting nor as multiple as in rheumatism ; there are very frequently nocturnal exacerbations ; there are less marked general reaction, fewer sympathetic symptoms, absence of sweating and cardiac complications, etc.

mittent form of the disease. Mercury is usually well borne in syphilitic fever, and in the rare cases in which it is found to disagree when given by the stomach, it may be administered in the form of inunction.

AFFECTIONS OF THE LYMPHATIC GLANDS.—*Lymphangeitis* may first be mentioned. In certain cases of syphilitic disease, delicate knotted cords, indicating the course of inflamed lymphatic vessels, can be perceived in the upper portions of the arms and thighs; they rarely extend towards the extremities. Jullien[1] reports the case of a woman who, three months subsequent to syphilitic infection, suffered with a general engorgement of all the lymphatic vessels and ganglia, coincident with the outbreak of a tubercular eruption. Ordinarily, lymphangeitis tends to resolution, and, moreover, it is not a striking lesion; evidence of its presence must be sought for, as otherwise it is apt to escape attention. *Adenitis*, on the other hand, is more apparent and obvious. Few persons affected with syphilis fail to show symptoms of adenitis in the secondary period. In twenty cases observed by Campana (quoted by Jullien), the glands of the groin were affected in every instance, those of the sides of the neck in thirteen cases, those of the nucha in eight, those of the sub-maxillary region in five, those of the crural region in three, those of the axillary, the parotid, the epitrochlear, and the submammary regions each in two instances. These little glandular nodules are in every respect similar to those attendant upon chancre; they may occur independently of any tegumentary disturbance, and simply as the expression of the presence of the virus in the ganglia. The generalized involvement of the lymphatic glands always lasts a long time, and only disappears very slowly by resolution. Occasionally, in strumous subjects, a secondary scrofulous inflammation may occur, resulting in the formation of the usual scrofulous glandular abscess. The glands of the submaxillary, subhyoid, and cervical regions, those situated anteriorly and posteriorly to the sterno-mastoid muscle, and possibly also those of the retro-pharyngeal region, are most apt to be thus affected. As regards the influence of the appearance of these lymphatic disturbances on the general prognosis of the disease, it is unfavorable if the glandular enlargement is marked and intense.

CONDITION OF THE SPLEEN.—The spleen may be affected in the stage of syphilis of which we are treating, being sometimes enlarged to the extent of passing four or five inches above the floating ribs. This enlargement is observed in from 7 to 8 per cent. of all cases,[2] and is usually accompanied by gastric disturbances and enteritis, boulimia, and polydipsia; occasionally vomiting and diarrhœa supervene.

ENLARGEMENT OF THE TONSILS is not an infrequent accompaniment of this stage of syphilis, these glands sometimes attaining considerable size, and giving rise to one form of deafness occurring at this period.[3]

SUPRA-RENAL CAPSULES.—Jullien[4] has drawn attention to the "pigmentary syphiloderm" (*vide infra*) as in all probability caused by syphilitic disease of the supra-renal capsules, of which the cortical portion at least is composed of lymphatic follicles.

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[1] Op. cit., p. 643.

[2] Attention was first called to this subject by Weil, of Heidelberg. (Ueber das Vorkommen des Milztumors bei frischer Syphilis. Deutsches Archiv für klin. Med., Mai, 1874, and Centralbl. f. die med. Wissensch., 1874, No. 12.)

[3] See Tanturri, Syphilitic lymphadenomata in the isthmus faucium. Rivista di Med., etc. Milano, Aprile, 1873.

[4] Op. cit., p. 647.

AFFECTIONS OF THE OSSEOUS SYSTEM.—The close connection between the medulla of bone and the lymphatic elements of other portions of the system, has induced Jullien to offer disease of this tissue as an explanation of the osteocopic pains (ὀστέον, bone, and κόπτω, to strike or beat, or ὀστέον, bone, and κοπόω, to weary) experienced at this stage of syphilis. The frequent occurrence of this symptom, its striking features, and its peculiar nocturnal exacerbation make it one of the most characteristic signs of the disease. In some cases no objective symptoms are noted, but more frequently the signs presented are those of periostitis. The pains are usually observed at an early period, sometimes showing themselves before the appearance of the eruption upon the skin. Patients complain of pains in various localities. The bones of the cranium—particularly the frontal—the ribs, sternum, and tibia, show various small, flat tumors, from one to two centimetres in diameter, raised, firm to the touch, and usually very tender and painful on pressure, even though spontaneously indolent. The frontal bone is, as has been said, the commonest seat of these pains; and the tenderness of the tissues is in some cases so acute at this point that patients cannot wear their hats. The middle portion of the ribs, and the lower third of the sternum, will generally be found to be the seat of greatest tenderness—the latter, indeed, offering an important aid to the diagnosis of syphilis on account of its very general occurrence. It has been suggested that the sensitive condition of the ribs will account, to some degree, for the occasional occurrence of that form of dyspnœa known as "syphilitic asthma," which is now and then observed at this stage of syphilis. This early form of periostitis usually gets well of itself in the course of a month or six weeks; but now and then, in cases of malignant early syphilis, it goes on to necrosis.

Another form of early bone trouble, known as *periostosis*, consists essentially in the development of non-inflammatory lesions of a bony character. It is usually a very early symptom, and may be induced by a blow, causing at first a limited traumatic periostitis, which may subsequently develop into the syphilitic lesion.

As regards the common seats of these lesions, Popescu[1] gives the following table:—

Situated on the frontal bone, in			.	.	.	27.9 per cent. of cases.
"	"	tibia,	. . . .		.	16.3 " "
"	"	ribs,	. . . .		.	13.9 " "
"	"	parietal bones,		. .	.	9.3 " "
"	"	ulna, radius, clavicle, lower maxillary, sternum, each,			.	4.6 " "
"	"	temporal, first metatarsal, fibula, occiput, each		. .	.	2.3 " "

These tumors are painful upon pressure, and spontaneously through the night; the feeling is as if the points affected had been beaten. Frequently they are found beneath the scalp, preventing the use of the comb, and on the crest of the tibia, where they may be no larger than a split pea; these little bony tumors afford an important aid to the diagnosis of latent syphilis. Under the influence of treatment the lesions disappear, but untreated they may last indefinitely.

AFFECTIONS OF THE LIVER.—That form of icterus which is found occasionally in connection with the early eruptions of syphilis, has been described by Gubler, Foville, Lacombe, and Delavarenne.[2] It appears, however, according to the latter, that the essential morbid entity is in reality an affection of the liver, accompanied or not by icterus, which is thus reduced to its proper

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[1] Thèse de Paris, 1873.
[2] Essai sur la Syphilis du Foie chez l'Adulte. Paris, 1879.

position of a symptom only. Early syphilitic disease of the liver shows itself either in the form of simple hypertrophy of this organ, or of hypertrophy accompanied by icterus, or pain, or both of these symptoms. It occurs in both sexes and at all ages, and usually shows itself from six weeks to two months subsequent to infection. The liver becomes enlarged to a very considerable degree, the entire organ being equally affected, and its surface remaining smooth and indurated. The average duration of the hypertrophy is from two and a half to three and a half months. In all reported cases which have been followed up, complete restoration of the liver to its normal volume has resulted.

Icterus is noticed in most cases of early syphilitic hepatic disease, but the cause of this symptom has not been satisfactorily explained. Jullien[1] believes it to be due to a catarrh of the bile-ducts, propagated from the gastro-intestinal canal, while Delavarenne attributes it to an infiltration of embryonic elements, due to the direct influence of the syphilitic poison, and giving rise to a more or less complete closure of the lumen of the ducts. In connection with the deposit of coloring matter in the skin, the conjunctiva, and the urine, other symptoms show themselves, such as gastric disturbance, diminution of appetite, occasionally slight febrile reaction, and almost always a certain degree of malaise and headache.

The occurrence of pain, which is usually experienced in connection with the hypertrophy of the liver accompanied by icterus, points to an inflammatory element in the morbid process. Sometimes discomfort alone is first observed, as a feeling of weight in the hypogastrium, soon developing into pain; at other times the pain, either spontaneous—when it is dull, and often intermittent—or provoked, as by percussion or manipulation—when it is acute—is observed from the beginning.

The concomitant symptoms of early syphilitic hypertrophy of the liver are important from a diagnostic point of view. Mucous patches of the throat, with erythematous or papular cutaneous lesions, are invariably found along with the hepatic disturbance. The icterus runs its course under treatment in about six weeks, but the hypertrophy does not ordinarily disappear in less than three months. The affection in itself is not grave, but it is considered to forebode a severe attack of syphilis, and is apt to recur subsequently in the form of more serious hepatic trouble. The treatment is that of syphilis generally.

DISTURBANCES OF THE URINARY FUNCTION.—*Albuminuria* has been noted in several cases as occurring in connection with early syphilis,[2] but, with perhaps occasional exceptions, the connection between the kidney affection and the constitutional disease has not been demonstrated.

Glycosuria, however, has been established as one of the accompanying symptoms of early syphilis, a number of cases having been reported[3] where this symptom occurred concomitantly with early syphilitic eruptions, and disappeared, together with the skin lesions, under anti-syphilitic treatment.

DISTURBANCES OF THE UTERINE FUNCTIONS.—These are in many respects analogous to the disturbances to which ordinary anæmia gives rise in women,

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[1] Op. cit., p. 652.

[2] Guiol, Essai sur l'Albuminurie Syphilitique (Thèse de Paris, 1867) ; Gailleton, Albuminurie Syphilitique coïncidente avec des accidents sécondaires (Giornale Italiano delle Malattie Veneree, t. ii. p. 95, 1869).

[3] Chiefly by Dub, of Prague (Präger Vierteljahrs. f. d. prakt. Heilk., 1863) ; Seegen (Der Diabetes mellitus auf Grundlage zahlreicher Beobachtungen. Berlin, 1875) ; and Servantie (Des Rapports du Diabète et de la Syphilis. Thèse de Paris, 1876).

and also to the conditions excited by the slow influence of certain toxic substances, such as lead. (Jullien.) *Leucorrhœa* and *uterine neuralgia*, together with *derangement of menstruation*, are among the commonest disturbances of the uterine functions. Menstrual disturbances, indeed, are almost always present in the graver forms of syphilis. It is well to keep this in mind, to prevent errors of diagnosis in cases of continued amenorrhœa under these circumstances.

The gravid uterus, however, feels most strongly the influence of the syphilitic virus. Unfortunately, the *syphilitic sterility* of some writers has no existence in fact, and syphilitic women only too often become pregnant while the disease is in full evolution. *Abortion* is one of the commonest results, and this has been explained upon three theories (Jullien): (1) By the direct action of the syphilitic virus upon the uterine fibres determining their contraction and the loosening of the membranes; (2) Congestion of the organ and consecutive asphyxia of the embryo; (3) Direct and primary poisoning of the fœtus by a morbid principle. The latter, Jullien considers the most probable.

Abortion is very common in early syphilis. Out of 390 pregnancies in syphilitic women, observed at the Lourcine Hospital, in Paris, 249 reached full term and 141 terminated in abortion or miscarriage; one case of death of the fœtus to every three pregnancies. The following striking case, noted by Fournier, may be cited in illustration of the effect of early syphilis upon pregnancy.

A woman had given birth successively to three fine children when she became infected with syphilis by her husband. Subsequently she had seven pregnancies. The first of these terminated at five months; the second at seven and a half months, the infant living twelve day ; the third almost at full term, but the fœtus was dead; the fourth and fifth terminated in premature delivery of a dead infant; the sixth and seventh were interrupted at the third month and the sixth week.

When proper treatment is carefully followed out in these cases, the successive pregnancies become more nearly normal, until finally a living infant is born, which may die almost immediately with symptoms of syphilis; the next pregnancy may result in a living child who may survive with or without a certain degree of syphilitic cachexia; and finally a perfectly healthy child may be born. I have observed this succession of events in a number of cases, and have even noted some instances of mild syphilis where the lapse of years appeared to have extinguished the violence of the virus, and where even without treatment gradual restoration to the normal condition had taken place.

As to the time at which syphilitic infection must take place in order to give rise to abortion, if it occurs before the fourth month of pregnancy, abortion is almost inevitable. Occurring at a later date, the danger progressively diminishes. The occurrence of placental lesions as a cause of abortion will be touched upon further on. Fournier has called attention to the occurrence of *hydramnios* in pregnant syphilitics. According to Fournier, too, the anæmia resulting from syphilitic infection predisposes also to *metrorrhagia* in the puerperal period. I have had occasion to confirm this observation in the case of a woman long under my care, in whom metrorrhagia has occurred repeatedly in several successive pregnancies, being in each instance cured by mercurials.

AFFECTIONS OF THE NERVOUS SYSTEM.—The affections of the nervous system in early syphilis are of two sorts : those due to the general cachectic condition of the system, and those brought about by mechanical irritation or pressure, as by enlarged ganglions or diseased bone. As has been said, the condition of the

system of some patients, during the early evolution of syphilis, is comparable to that induced by severe hemorrhages. There are *palpitation* of the heart, tendency to *syncope, asthenia, languor, loss of appetite*, etc., all of which are closely connected with nervous disturbance. In women, the various nervous manifestations of syphilis, from simple neuralgia to intellectual perversion of various kinds, are much commoner than in men. It is characteristic of all the various nervous disturbances of early syphilis, that they are essentially transitory. The later nervous manifestations show a very different aspect. *Sensory disturbances*, such as dizziness, dilatation of the pupils, amblyopia, ringing in the ear, earache, and deafness, are not uncommon. *Insomnia*, without any ascertainable cause, is also a nervous symptom occasionally observed.

The *cephalalgia* of early syphilis—by which is understood a deep-seated pain in the brain, and not the pain situated in the bony tissues or the meninges—is a common and stubborn symptom, occurring to a greater or less degree in almost every case of syphilitic disease. It is usually experienced in the frontal protuberances, the temples, or the occipital region. In its lightest forms it is only perceived as a feeling of discomfort, which does not prevent the patient from attending to his ordinary avocations. In a severer form, it takes the aspect of a headache, so severe as to interfere with mental occupation and to prevent sleep. In rare cases, it assumes extreme severity, causing agonizing and unbearable pain. Patients describe the sensation as of lancinating pain, or as if the head were being squeezed in a vise or struck by the blows of a hammer; the pain is continuous, but with nocturnal exacerbations. This form is rare. The intermittent variety is of more frequent occurrence. Here the pain comes on at the approach of night and passes off in the morning. Left to itself, the cephalalgia of early syphilis may pass away in a few days, or it may last indefinitely. Mercury exercises a complete mastery over it, and, vigorously employed, will bring speedy and complete relief. It is best given in the form of fractional doses of calomel, or by inunction, by which method its effects are most rapidly produced. (See under the general treatment of syphilis.) Iodide of potassium is also useful.

The general disturbance of the system caused by syphilis often induces the outbreak of some *latent neurosis*, or the *exasperation* of a *pre-existing neurosis*. This is especially the case with hysterical and epileptic patients. Occasionally the syphilitic poison develops hysteria or epilepsy in individuals previously completely exempt from either of those nervous affections. *Hysteria* may suddenly appear, with all the usual symptoms of fixed or erratic painful sensations, loss of strength, syncope, spasms, and convulsive crises. *Epilepsy* of a transitory character, but presenting no especially characteristic symptoms to denote its origin, may also develop. The diagnosis in this latter case is difficult, but it should be borne in mind that all cases of epilepsy, occurring for the first time at adult age without any perceptible cause, must be strongly suspected to be of syphilitic origin. In addition, however, it should be remarked, as indicating the syphilitic origin of this manifestation, that the crisis is incomplete, and the spasm limited to a single side. The coexistence of other cerebral symptoms, particularly cephalalgia, and of characteristic cutaneous eruptions, will also point to the true nature of the affection. Epilepsy is not very rare in early syphilis; Diday and Little have observed it in the third and fourth month respectively. The exact pathological character of the lesions which give rise to these cerebral symptoms has not as yet been ascertained. They are to be distinguished from the later syphilitic brain-troubles which will be discussed further on in this article.

Analgesia, general, or more frequently in scattered areas, is one of the curious nervous phenomena which are met with in the early stage of syphilis. It is a somewhat rare affection, and is almost always symmetrical. It may

be sought for on the extensor surfaces of the limbs, on the dorsal aspects of the forearms, and, above all, over the metacarpus, where it may be found alone in some cases, but where it almost always exists when it also occurs elsewhere. The cheeks and the mammary region are often affected by this peculiar insensibility, which may also extend to the mucous orifices of the body. At these points, even a deep prick with a sharp instrument is perceived only as contact, without giving the least pain. Tactile sensibility is usually present to a normal degree over the analgesic areas.[1] *Anæsthesia* is much rarer than analgesia, and never occurs alone. Fournier notes several other disturbances of sensation, such as *thermo-anæsthesia* (he gives the case of a patient who burned himself severely with a red-hot iron, not perceiving its temperature by the touch), *muscular analgesia*, and even *abolition of the muscular sense*. Patients in this last condition cannot perceive motion or rest, and only know by ocular examination when the position of their limbs has been changed. Of course, all these peculiar nervous disturbances are very rare.

The *sympathetic system* is also involved in some cases. *Algidity*, with depression of the surface temperature, which may descend to $82.4°$, $78.8°$, $77°$, or even to $73.4°$ F., is occasionally observed. The extremities are cyanosed, and feel like ice; the pulse suddenly becomes filiform, and creeping chills are experienced. The depression is most marked at night. Sometimes sensations of heat are observed, coming in puffs about the head and spreading down through the body to the extremities. Still rarer is the occurrence of *hyperidrosis*, generalized and intermittent sweats, usually nocturnal or following slight fatigue; occasionally profuse perspiration of the extremities alone is observed.

In all these cases the pathology is a matter of pure conjecture. Nothing is known of the organic changes which induce the various morbid phenomena observed clinically.

Neuralgia in early syphilis is usually localized in the frontal and suborbital branches of the trigeminal; it is usually worse at night, and may easily be mistaken for the deep cephalalgia above described, or for the pain symptomatic of cranial bone-trouble. Among the other nerves which are sometimes affected, may be mentioned the lingual, auricular, mastoid, great occipital, lumbo-abdominal, crural, and sciatic, the latter usually being attacked in part of its course only. When the intercostals are affected, the neuralgia may contribute to the occurrence of "syphilitic asthma," and when their branches running to the mammæ are involved, mastodynia ensues—a not uncommon, but most painful and stubborn symptom. Sometimes neuralgia is the first, and, for a time, the only, symptom of generalized syphilis. In all cases of mysterious and rebellious neuralgia, mercurials should be exhibited. The rapid disappearance of the painful symptoms under their use will furnish the best touchstone of the presence of syphilis, and a test of which the use in such cases is justifiable.

The various forms of *paralysis* observed in early syphilis are also remarkable for the rapidity with which they yield to mercury and iodide of potassium. In connection with the facial nerve, *akinesia* is frequently observed; inertia or immobility of the muscles connected with expression, labial deviation, and depression of the cheek and of the corresponding side of the nares, are among the commonest symptoms of this affection, which often supervenes at a very early date.[2]

Hemiplegia is a rare but sometimes-encountered affection of the latter

[1] See Wigglesworth, Analgesia in Secondary Syphilis (Boston Med. and Surg. Jour., April 14, 1870).

[2] Balmano (Gaz. des Hôpitaux, 1863, p. 582) has reported a case where facial palsy supervened a month after the infecting coitus, and on the seventh day of the erythematous eruption.

stages of early syphilis, occurring toward the sixth month, preceded by headache, often accompanying a fresh cutaneous outbreak, and going on to gradual development of the characteristic symptoms, without impairment of the intellect. Treatment in these cases should be prompt and vigorous. Administered in good time, specific medication is followed by rapid amelioration of the various symptoms, but a delay of even a week before beginning treatment may lead to very slow cure.

Other nervous affections, such as paraplegia, aphasia, meningitis, and the various myelopathies, may occur in the early periods of syphilis, but as the symptoms then presented in no way differ from those displayed by the same affections when occurring late in the course of the disease, reference may be made to their description further on.[1]

LESIONS OF THE ARTICULATIONS AND OF THE SYNOVIAL CAVITIES OF THE TENDONS.—Described by the early syphilographers, the study of these lesions appears to have been overlooked in more modern times until a comparatively recent period. Richet,[2] about 1851–3, recalled attention to the occurrence of *syphilitic synovitis*, and the transitory lesions of the articulations have since been studied by Lancereaux[3] and Vaffier.[4]

One syphilitic in ten, among men, and a greater proportion among women, suffers even during the first prodromic period, before the appearance of the chancre, with vague rheumatoid pains, worse at night, and aggravated by rest in bed while somewhat lessened during exercise. These are still more commonly found in the early stage of generalized lesions. They begin by a period of general lassitude and fatigue, particularly upon waking in the morning; the limbs seem stiff, and are moved with difficulty; rest in bed is more tiresome than standing. At a later period actual pain supervenes, with morbid sensitiveness on pressure, in the wrists, shoulders, knees, or ankles. The generalized eruption appears at this time. Under the influence of specific treatment, or even spontaneously, these symptoms disappear, leaving occasionally some slight creaking in the joints.

Poly-arthritis of a subacute character may occur after eight or ten days of prodromic joint pains. It resembles ordinary rheumatism so closely that it

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[1] The following references are given to facilitate the further study of this very interesting series of nervous phenomena of early syphilis :—
Fournier, La Syphilis du Cerveau. Paris, 1879.
Castlenau, Nevralgie Syphilitique. Cazenave's Annales, t. i. p. 212.
Marty, Paralysie du facial au début de la Syphilis. Gaz. des Hôpitaux, 1863, p. 473.
Diday, Épilepsie Syphilitique. Giornale delle Malattie Veneree, t. iii. p. 46, 1867.
Gros and Lancereaux, Des Affections Nerveuses Syphilitiques. Paris, 1861.
Little, Epilepsy of Syphilitic Origin. Med. Press and Circular, 1868.
Mavreyeni, Scelotirbe sifilitico ; guarigione. Gaz. Méd. d'Orient, 1868.
Fournier, De l'Analgésie Syphilitique sécondaire. Annales de Dermatol. et de Syph., t. i., 1869, p. 486.
Soresina, Sifilide del sistema nervoso ; macchie pigmentali su tutta la persona. Giornale Ital. delle Malattie Veneree, t. ii., 1869, p. 87.
Moustapha-Faid, Troubles de la Sensibilité ; Analgésie Syphilitique. Annales de Dermatol. et de Syph., t. iii. p. 318.
Aparico, Tremblement Syphilitique. Thèse de Paris, 1872.
Gay, Cases of Secondary Cerebral Syphilis. Annales de Dermatol. et de Syph., t. v., 1873, p. 469.
Bruberger, Ein Fall von Meningitis syphilitica nebst Bemerkungen über Syphilis der central Organs. Archiv f. path. Anat. (Virchow), Bd. xl., S. 235, 298.
Mauriac, Mémoire sur les Affections Syphilitiques Précoces des Centres Nerveuses. Ann. de Dermatol. et de Syph., t. vi., 1875, pp. 161, 265, 354, 427.
Finger, Ueber eine constante nervöse Störung bei florider Syphilis der Secundärperiode. Vierteljahrsschr f. Derm. u. Syph. viii. Jahrg., 1881, S. 255.
[2] Mémoire sur les Tumeurs blanches. Mém. de l'Acad. de Méd., t. xvii. Paris, 1853.
[3] Mémoire communiqué a la Société de Chirurgie, Sept. 1863.
[4] Rhumatisme Syphilitique. Thèse de Paris, 1875.

has sometimes been questioned whether it is not a coincidence of this affection with syphilis.[1] But the absence of profuse sweating and of visceral symptoms, the presence of simultaneous affections of the serous sacs, and the long duration of the morbid condition, together with the obstinate resistance of the affection to ordinary remedies and its yielding to specific treatment, all speak in favor of a syphilitic origin for this form of articular trouble.

Arthritis with effusion, or *hydrarthrosis*, is a later lesion than the preceding, and may even occur two or three years after the appearance of the initial lesion. Its beginning is not accompanied by pain, and the intra-articular effusion may attain a considerable volume before the patient's attention is drawn to it. When this occurs in the knee-joint, nothing except its size and a slight difficulty in walking denotes the presence of articular disease. The knee of one side alone is most generally attacked.

When the nature of the joint trouble is discovered in time, the mercurial treatment causes it to disappear with great rapidity, but when untreated, considerable thickening of the synovial tissues may take place, a thick secretion may be poured out, and a true syphilitic tumor may ensue, of a character to be treated of under the head of late syphilitic affections of the joints.[2]

The *tendinous sheaths* and *serous bursæ* are sometimes affected in early syphilis. In one variety of these affections, there is effusion into the serous sac surrounding the extensor tendons of the fingers, without tenderness or inflammatory symptoms, forming a sharply circumscribed, flattened, triangular tumor, with the apex towards the fingers, occupying the carpo-metacarpal region without extending beyond the transverse dorsal ligament. There is slight pain on pressure, with some little difficulty and weakness in the movements of the wrist. The occurrence of this affection in connection with the generalized skin symptoms of syphilis, and its rapid disappearance under the influence of specific treatment, will serve to establish the diagnosis. The prognosis is favorable.

The somewhat similar affection known as *acute hydropsy* of the tendinous sheaths gives rise to considerable pain spontaneously or upon pressure. This form commonly occurs[3] in the shoulder, knee, and instep, where the synovial sacs are numerous, and also on the posterior aspect of the olecranon and on that of the calcaneum; it may, in fact, occur wherever there are tendons with attached synovial bursæ. *Hygroma* is a similar manifestation of early syphilis.

MUSCULAR CONTRACTION.—This is one of the most puzzling of the affections of early syphilis, and particularly so because its pathology is absolutely unknown. No lesion is known to account for the peculiar symptoms presented.[4] These commonly affect the flexor muscles of the arm, although others are occasionally involved. The movement of the forearm upon the arm begins, without pain or other symptom, to become gradually less free, and, as if forced by an irresistible power, the forearm becomes flexed in an obtuse angle upon

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[1] Baumler, and Duffin (Cases of Syphilitic Rheumatism. Trans. Clin. Soc. London, 1869, vol. ii. p. 81) have described these forms at length.

[2] See Fournier on the affections of the apparatus of locomotion in the secondary period of syphilis. Union Méd. de Paris, 1873, Nos. 21, 25, 28, 46, 48, 49.

[3] Important contributions to this subject are the papers of Verneuil, Hydropisie des Gaines Tendineuses dans la Syphilis (Gaz. Hebdom., 1868, p. 609); and Fournier, Note sur les Lésions des Gaines Tendineuses. Paris, 1868. (Reprint from Gaz. Hebdom., p. 645.) Vaffier also describes this lesion (op. cit.).

[4] The best and fullest description of this affection is that given by Mauriac in his prolix but important monograph, Des Myopathies Syphilitiques, Paris, 1877; a reprint of articles appearing in the Annales de Dermatologie et de Syphiligraphie, t. vii., 1876.

the arm to a greater or less degree,[1] and extension becomes impossible, although further flexure may be performed in some cases, while in others complete ankylosis exists. No lesion or alteration can be perceived in the size, shape, or appearance of the tissues involved. The tendon of the biceps, the muscle involved, is tense and hard as iron. Forcible extension has been made in some cases. This causes much pain and does no good, the muscle gradually contracting again as soon as the force is removed, until the forearm assumes its former position of flexion.

While the biceps brachii is the muscle usually implicated, the flexors of the leg may be involved, or the muscles of the jaw may contract, and give rise to a condition of "lock-jaw;" those of the neck may give rise by their contraction to a sort of torticollis; strabismus may be caused by contraction of the muscles of the eyeball; and lumbago, with incurvation of the trunk, by involvement of the sacro-lumbar muscles. Writers[2] have even described constrictions of the trachea, œsophagus, and rectum, as well as asthma, as the result of syphilitic involvement of the various muscles concerned; but these observations have as yet lacked confirmation, although there is nothing intrinsically improbable in the occurrence of these affections under such circumstances.

Syphilitic contraction of the muscles is commonly rather a late affection,[3] but it may occur simultaneously with the earlier manifestations of syphilis. The duration of syphilitic muscular contraction depends entirely upon its treatment. Under the employment of specific remedies it disappears sometimes with great rapidity, at other times more slowly.

Influence of the General Syphilitic Condition upon Intercurrent Affections.—It is generally believed that the various internal affections with which the patient may chance to be affected while the syphilitic disease is active in his constitution, are more or less influenced thereby. Exact observations bearing upon this point are, however, wanting. Regarding the influence of syphilitic disease on traumatic affections, our knowledge is more exact, and this point will be found treated of in another part of the present work.[4] (See Vol. I. p. 319.)

The Syphilodermata.

The syphilitic eruptions of the skin are characterized by certain peculiarities which they possess in common, and which serve to differentiate them from other skin affections. These are as follows: 1. Polymorphism; 2. Peculiar color; 3. Rounded form; 4. Apyretic, indolent, apruriginous character; 5. Amenability to the curative influence of mercury.

Polymorphism is the peculiar feature of the early syphilitic skin affections. They are often made up of various eruptive lesions: an erythematous syphiloderm may occur in connection with groups of papular lesions,[5] and papulo-squamous eruptions may show mingled pustules or crusted lesions. Occasionally a patient will show, on careful examination, macules, dry and moist

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[1] In three cases which came under my observation (Three Cases of Syphilitic Muscular Contraction, Am. Jour. Med. Soc., 1879), the arm was flexed at the angle of 165°, 150°, and 135° in each case respectively.

[2] Bouisson, Tumeurs Syphilitiques des Muscles (Annales de Cazenave, t. iii. p. 52, 1850), and Davasse.

[3] In one of my cases the contraction manifested itself in the seventh month; in the other two, between the twelfth and the fourteenth months of the disease.

[4] Jullien, op. cit., p. 670, goes into the subject with some fulness, and adds references to a number of recent articles bearing upon the matter under consideration.

[5] See illustration of Infantile Syphilis, Pl. XIV., Fig. 1.

papules, scales, vesico-pustules, pustules, crusts, etc., all associated together.[1]
It is quite different with non-syphilitic skin eruptions, which are usually
found possessing a tolerably uniform character throughout. Thus in the
eruptive fevers, the type of the eruption prevails over all the affected parts;
in erythema simplex, the eruption is erythematous; in purpura, macular; in
herpes, vesicular, etc. These points are often of great diagnostic value, but
it must be remembered that there are numerous exceptions to the rule, both
in syphilitic and in non-syphilitic eruptions, so that this symptom is not to be
invariably depended upon.

The peculiar color of syphilitic eruptions has at all periods arrested the at-
tention of observers. It is a very striking color, varying in tint according to
the subject, the stage of the disease, and the locality. In some cases it is
brownish-red—precisely the shade of lean ham; in other instances it is a
brighter, slightly yellowish shade of red, resembling the color of a freshly
cut surface of copper. The former color is more apt to be observed in lesions
of the lower extremities, while the coppery hue is peculiarly characteristic
of some forms of tubercular syphiloderm occurring about the face. Though
sometimes of service in aiding in the diagnosis of a doubtful case, too much
stress must not be laid upon the diagnostic value of color, since the syphilo-
dermata do not always present it, while it is occasionally found in non-syphi-
litic skin diseases.

The *peculiar, rounded,* or *circinate* form or arrangement of the syphilitic
skin lesion or group of lesions is, when present, of importance from a diag-
nostic point of view. The syphilitic lesion itself is almost invariably rounded
in form, and, when grouped, the various lesions are very apt to assume a dia-
dem-like arrangement, or that of a crescent, or of the arc of a circle of greater
or less extent. Like the polymorphism and the color of the syphilodermata,
this characteristic is not invariably to be depended upon, but is often a valu-
able aid to diagnosis in obscure cases.

The *apyretic, indolent, apruriginous* nature of the syphilitic eruptions is
a very marked feature in their character. This alone differentiates them from
the entire class of acute and febrile exanthemata, and particularly from the
eruptive fevers, in which, as is known, the skin lesions make their appearance
and are developed with the accompaniment of fever, together with inflamma-
tory symptoms, and run a transitory career. It is true that some of the
syphilodermata, and notably the early general eruptions, are occasionally ac-
companied in their early development by more or less fever. This, however,
is not only uncommon, but, when the febrile movement does occur in connec-
tion with the outbreak upon the skin, the temperature does not rise to a high
degree, and it very often quickly falls again.

Fournier cites a curious case occurring under the care of a distinguished colleague,
where a patient was admitted to hospital with high fever, together with other symp-
toms which caused the diagnosis of *typhoid fever* to be reached. Forty-eight hours after-
wards, numerous small rose-colored, slightly raised papules made their appearance over
the whole body, when the diagnosis was changed to *smallpox.* But instead of becom-
ing transformed into vesicles and pustules, these papules simply continued to grow in
size and to alter gradually in appearance, until, at length, it came to be seen that be-
yond a doubt the affection was syphilitic. The fever meanwhile had disappeared.

Once fully developed, the syphilodermata run their course absolutely
without any accompanying fever or inflammatory symptoms of any sort.[2]
They are also quite indolent and sluggish in their course, the lesions remain-

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[1] This does not refer to the late syphilodermata, which usually preserve a single type only.
[2] Excepting the occasional development of erysipelas, which I have not infrequently observed
in connection with the development of gummata.

ing often for weeks and months without change; in fact, untreated, certain syphilitic eruptions may last unchanged for years. Of course, this peculiarity of the syphilodermata differentiates them sharply from the various eruptive fevers, and from the febrile pseudo-exanthemata, the spontaneous evolution of which is always rapid, and their duration comparatively ephemeral.

The syphilodermata are usually *apruriginous*, in fact, without any sensation of any kind. It not infrequently happens with regard to the early eruptions, and particularly in the case of the erythematous eruptions, that the patient's attention is first called to the existence of the affection by the physician who is examining him. Occasionally the early syphilitic eruptions do itch a little, especially when they first make their appearance. Patients are not often driven to scratch, however, as is the case in the other eruptions for which they might be mistaken.

The syphilodermata, or some of them, when they affect the scalp, axillæ, sternal region, anterior aspect of the limbs, etc., are likely in some cases to excite a certain amount of pruritus. I had under my care some time ago a woman suffering from an eczematiform eruption of the scalp (see under Vesicular Syphiloderm), who suffered from intense pruritus during the entire course of the affection. Pruritus, however, is very rare in any case.

The syphilodermata are all amenable to the influence of mercury. This fact, which has been known since the end of the fifteenth century, is now settled beyond question. Occasionally a syphiloderm may for a time appear rebellious to the influence of mercury, but, on the other hand, a questionable eruption which yields to this touchstone[1] may with certainty be regarded as of syphilitic origin.[2]

CLASSIFICATION OF THE SYPHILODERMATA.

The syphilodermata are classified according to their pathological character as follows:—

    I.   ERYTHEMATOUS.
    II.   PAPULAR.
        (a) Small papular.
        (b) Large papular.
        (c) Moist papular.
        (d) Vegetating papular.
        (e) Papulo-squamous.
    III.   VESICULAR.
    IV.   PUSTULAR.
        (a) Small acuminated pustular.
        (b) Large acuminated pustular.
        (c) Small flat pustular.
        (d) Large flat pustular.
    V.   TUBERCULAR.
        (a) Tubercular serpiginous.
        (b) Tubercular vegetating.
    VI.   GUMMATOUS.
    VII.   BULLOUS.
    VIII.   PIGMENTARY.

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[1] This touchstone of treatment should, however, be reserved only for cases where the diagnosis remains uncertain after every effort to make it out from the symptoms.

[2] The clearest and most satisfactory description of the syphilodermata in the English language is to be found in Duhring's Treatise on Diseases of the Skin, 2d ed., p. 470 et seq. Fournier, op. cit., 2e éd., p. 258 et seq., gives the fullest account of these lesions with which I am acquainted.

In the following pages the various syphilitic affections of the skin will be treated of under the headings above given. It was formerly the custom to regard certain classes of the syphilodermata as belonging to "secondary syphilis," while others were considered as "tertiary" manifestations. But as in practice it is often found that the different eruptions appear at an earlier or later date than that assigned to them, thus confusing the mind regarding the stage of the disease in any given case, I have preferred to adhere simply to the pathological classification, indicating under the various classes of syphilodermata the date at which each commonly makes its appearance.

Erythematous Syphiloderm.

The erythematous syphiloderm is the earliest and one of the commonest skin manifestations of syphilis. Although so common that few patients escape it, yet it is so entirely without subjective symptoms, and so apt to be confined to those parts of the body which are covered with the clothing, that it very frequently comes and goes unnoticed. In the lower classes and in hospital practice it is indeed so seldom noticed, that, were not the opposite fact well confirmed by other observations, it would seem to be one of the rarest skin affections in syphilis.

The erythematous syphiloderm commonly makes its appearance as the initiatory lesion of generalized syphilis, about the sixth or eighth week after the appearance of the chancre (on an average on the forty-fifth day). Occasionally, however, it may appear at a much later date, even toward the end of the first or the beginning of the second year, when its advent has been hindered by mercurial treatment. Under these circumstances the eruption displays somewhat different features from those presented when it appears at what may be called its normal period.

The erythematous syphiloderm presents itself in the form of diffuse macules or colored patches, of from pin-head to small-coin size, irregularly rounded, oval, or of various shapes.[1] Sometimes a number of lesions coalesce to form a large patch. At first the lesions are of a pale rose-color, afterwards the color deepens, and, as the eruption begins to pigment and pass away, it assumes a yellowish-brown tint, and then a brownish color. The maculæ at first disappear under pressure, but when pigmentation occurs they are persistent. As has been said, the eruption gives rise to no subjective sensations. The distribution of the erythematous syphiloderm is irregular. It is less apt than any of the other syphilitic skin lesions to assume a circinate form. The regions of the body usually attacked by it are the flanks and lateral portions of the thorax, the abdomen, chest, and back. The eruption is also frequently observed upon the flexor surfaces of the limbs. It is rarely observed upon the face, excepting over the forehead at the edge of the scalp, and only very exceptionally upon the hands.

Fournier[2] describes two special varieties of erythematous syphiloderm, one urticaria-like, and the other circinate. The latter is one of the later syphilitic skin manifestations, appearing toward the end of the first year or in the course of the second or third year. It may even occur at a still later stage when a course of mercurial treatment has been pursued. The circinate form is a very marked feature; circles or parts of circles, figures-of-8, etc., are often observed. Sometimes the circles are of quite a large diameter, even two or three inches. Usually they are from half an inch to an inch in diameter. This variety, if left without treatment, may last a long time. Mercury quickly cures it, but the disease is apt to recur. The circinate form of the erythematous syphil-

[1] See Duhring's Atlas of Skin Diseases, Pl. I. [2] Op. cit., 2e éd. p. 277.

oderm is liable to be mistaken for *erythema annulare, gyratum*, or *marginatum.* The eruption of the latter affection, however, is more methodically arranged ; it is of a deeper red color, is raised above the surface, is most apt to occur on the backs of the hands and feet, is more ephemeral, and is likely to be found during the spring and autumn.

The *diagnosis* of the erythematous syphiloderm is usually not difficult. It is commonly accompanied by some of the other symptoms of syphilitic infection, general malaise, nocturnal headache, wandering pains in the limbs, sore throat, etc., while not infrequently the traces of the chancre and the involvement of the inguinal and other glands can be made out.

DIFFERENTIAL DIAGNOSIS BETWEEN THE ERYTHEMATOUS SYPHILODERM AND SIMPLE ERYTHEMA.—(*Fournier.*)

ERYTHEMATOUS SYPHILODERM.	SIMPLE ERYTHEMA.
(1) Usually apyretic.	(1) Often accompanied by feverish symptoms, loss of appetite, coated tongue, thirst, malaise, and headache.
(2) No itching.	(2) Very frequently more or less itching.
(3) Lasts several weeks at least.	(3) Ephemeral.
(4) Preceded a short time by the symptoms of syphilitic infection, chancre, glandular involvement, etc.	(4) No previous symptoms of syphilitic infection.
(5) Accompanied by other syphilitic manifestations, crusts in the scalp, enlargement of the cervical glands, evening headache, lesions of the mucous membranes, etc.	(5) Not accompanied by secondary syphilitic symptoms.

DIFFERENTIAL DIAGNOSIS BETWEEN THE ERYTHEMATOUS SYPHILODERM AND DERMATITIS FROM COPAIBA.—(*Fournier.*)

ERYTHEMATOUS SYPHILODERM.	DERMATITIS FROM COPAIBA.
(1) Eruption not pruritic.	(1) Eruption sometimes itches slightly, at other times quite severely.
(2) Eruption rose-colored, without a vinous tint.	(2) Eruption deeper in color, having more of a wine tint than the syphilitic manifestation.
(3) Eruption without special points of concentration.	(3) Eruption shows a tendency to confluence at certain points, such as the extensor surfaces of the joints.
(4) Eruption persistent at least for some weeks.	(4) Eruption ephemeral, disappearing in a few days when the drug has been discontinued.
(5) Eruption follows the symptoms of syphilitic infection without any drug having been taken.	(5) Eruption follows a special cause, recent ingestion of copaiba.

The *evolution* of the erythematous syphiloderm is slow. Unlike the febrile exanthematic eruptions, which reach their full development in from twenty-four to forty-eight hours, it first shows itself by a patch of eruption here and there ; more patches follow, and day by day new lesions succeed, the eruption taking a week or more to unfold itself completely. Once fully developed, it remains unchanged for a considerable period. Under the influence of treatment it fades rapidly, but left alone it may persist for weeks or months, becoming darker and partially pigmented, while new forms of syphiloderm may meanwhile make their appearance. At this period the eruption is no longer

an erythematous, but a polymorphous, syphiloderm—erythematous in one place, papular or pustular in another. It is usually in this last aspect that the eruption shows itself in practice. The erythematous syphiloderm, pure and simple, is not by any means as frequently encountered as this mixed eruption made up of various lesions.

Finally, the erythematous eruption disappears, the pigmentation is gradually absorbed, and the skin shows no trace of the former disease.

The erythematous syphiloderm may recur, in which case it shows itself under a somewhat different aspect, the lesions being larger, fewer in number (sometimes only a dozen in all), more scattered, and of a rather paler tint. When mercury has been given, the erythematous syphiloderm rarely recurs, and when it does so it is only after a long interval. When this form of the erythematous syphiloderm is found upon a patient, the disease may be regarded as of old date.

Papular Syphiloderm.[1]

The papular syphiloderm is characterized by the appearance of small, hard, solid elevations of various size, not containing fluid, and of a coppery or ham-red color, terminating in resolution. It assumes various forms, and may be best described under the following heads: (*a*) small papular syphiloderm; (*b*) large papular syphiloderm; (*c*) papulo-squamous syphiloderm; (*d*) moist papular syphiloderm (mucous papule); (*e*) vegetating syphiloderm.

Small Papular Syphiloderm.—This consists of an eruption of single and disseminate, or grouped and more or less confluent, pin-head or small pea-sized, distinctly elevated, hard, rounded, or pointed papules. They give the impression of roughness when the hand is passed over the surface of the skin. The summit of the papules may be smooth or covered with fine scales. The eruption is apt to be complicated by the occurrence of miliary pustules.[2] It is at first of a bright-red color, but subsequently assumes a dusky tint. It is a well-marked eruption, usually occupying a considerable area, and is most frequently seen about the shoulders, arms, trunk, and thighs.

The small papular syphiloderm may occur either as one of the first general manifestations of syphilis, as early as the third or fourth month after infection, or it may not show itself until later, after other lesions have occurred. It is apt to be chronic in its course, and often resists treatment with some stubbornness. Relapses are not infrequent. Other lesions are apt to be present concomitantly, notably large flat papules, moist papules, and small pustules, as mentioned above. The affections for which it may be mistaken are *keratosis pilaris*, especially when the papules are numerous and scattered, pierced by a hair, and in the colored race, and *psoriasis punctata*. Occasionally it is confounded with *eczema*, but the pruriginous character of the last-mentioned affection, its history, and the absence of concomitant syphilitic symptoms, should prevent the occurrence of such a mistake.

Large Papular Syphiloderm.—This is composed, as its name indicates, of lesions larger than those just described, the papules varying from one-half to three centimetres in diameter, being usually roundish in outline, raised above the general surface of the skin, and flat. To the touch they are firm and

[1] See R. W. Taylor, Observations on the Papular Syphilides (Am. Jour. Syph. and Derm., April, 1870); and On a Peculiarity of the Papular Syphilide in the Negro (Ibid., April, 1873).
[2] See an excellent representation of the papular syphiloderm, accompanied by miliary pustules, in Duhring's Atlas of Diseases of the Skin, Plate I.

circumscribed. In their early stage they are commonly smooth and free from scales. They are usually ham-colored, although occasionally light or very deep red in tint. While often present in considerable numbers, the lesions are not as numerous as in the small papular variety. The lesions may be found scattered over different parts of the body, or collected in one locality in groups or patches. The forehead (*corona veneris* of older writers), region of the mouth, nape of the neck, back,[1] flexor surfaces of the extremities, scrotum (Plate X. Fig. 1), labia, perineum, and margin of the anus, are the localities where this eruption is ordinarily encountered.

The large papular syphiloderm is one of the commonest skin manifestations of syphilis. It may occur early or late in the course of the disease, or it may occur as a relapse. Commonly it follows closely on, or accompanies, the erythematous eruption. The lesions appear in divers localities and of different sizes in the course of a few weeks, and are met with in various stages of growth. Once formed they remain for some time—weeks or months. The large flat papular syphiloderm yields more readily to treatment than the small variety. Where the lesions occur in certain localities, their appearance and character may become considerably modified. About the mouth or anus, and occasionally upon the hands and feet, deep fissures sometimes form, giving rise to great annoyance and pain.

THE MOIST PAPULE.[2]—A common transformation of the large flat papular syphiloderm is into the moist papule. Moist papules may occur either upon the general surface of the skin, or upon the muco-cutaneous tissues about the mouth, vulva, anus, etc. The lesion as it occurs upon the skin, begins by a red spot which soon assumes the form of a papule, more or less elevated above the general surface, its borders higher than the somewhat depressed centre, the latter covered with a thin crust under which, on raising it, the moist surface of the lesion can be seen. When the evolution of the lesion goes on to a cure, the crust falls off leaving a thin epidermic scale beneath, and it finally disappears without a subsequent scar. Sometimes a copious eruption of the large flat papular syphiloderm may take on this character, and the lesions may assume the appearance of moist papules. A not very uncommon occurrence is the transformation, *in situ*, of the chancre into a moist papule. As the initial lesion is about to disappear, it suddenly springs into new life again; induration recommences, the lesion becomes larger and more elevated above the surrounding skin, its surface becomes moist, begins to secrete, and, becoming crusted or not according to location, is often distinguished with difficulty from surrounding lesions of an apparently similar character, the lesions of the generalized eruption.

Moist papules of the muco-cutaneous integument are closely analogous to those occurring on the skin generally. In some cases, this form of the moist papule assumes the character of a smooth papular elevation of regular contour, slightly darker in color than the surrounding mucous membrane, with a moist surface secreting an abundance of muco-pus of a characteristic and disgusting odor. This variety is rarely isolated, but is usually accompanied by other moist papules, and also by a papular eruption upon the skin. Its commonest seat in man is about the glans, and on the scrotum (Plate X. Fig. 1). In women it is most commonly met with on the external genitals, in both

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[1] See Duhring's Atlas, Plate AA.

[2] This form of the syphilitic papule is often known by the name of "mucous patch," but I prefer to restrict that designation to the lesions, which may or may not be papular in character, occurring on the mucous membranes only. The two varieties of the disease run into one condition on the muco-cutaneous surfaces, but are essentially distinct when met with in their typical form. (See Syphilis of the Mucous Membranes.)

PLATE X.

Moist papules of scrotum and buttocks.   Mucous patches of mouth and tongue.

sexes about the anus, and in the infant about the umbilicus. This variety of the moist papule is most liable to hypertrophy and the formation of vegetations, of which mention will be made hereafter.

A second variety of the moist papule occurring on the muco-cutaneous surfaces, consists in a superficial ulceration without a true papular formation, denuding the epithelium merely, and looking like a superficial desquamation or denudation rather than the serious lesion which, in fact, it is. This variety is commonly met with in women, upon the vulva, and is occasionally observed to become more indurated and take on a papular character, or to ulcerate, or finally to become covered with a diphtheritic membrane.

Moist papules when seated upon the commissures of the lips, between the roots of the fingers, etc., often assume the form of fissures. On the vulva they are, when numerous, not infrequently accompanied by a sort of firm œdema which persists even after they have been cured. When moist papules secrete abundantly, they often give rise to severe itching, and now and then even to inflammatory reaction with pain.[1]

VEGETATING PAPULES.—Instead of being flat, the moist papule may take on hypertrophic action resulting in the formation of luxuriant warty or papillary growths, when the lesions are entitled *vegetating papules*. The lesions assume an elevated, more or less circumscribed, warty character, resembling the raspberry or cauliflower formation. Between the papillary growths there may be slight ulceration accompanied with offensive secretion, which, drying, forms yellowish or brownish crusts. This condition is most prone to occur on the face, scalp, about the shoulders, and near the genitals (Duhring). It is on no account to be confounded with the acuminated or "venereal" wart, which will be described in the following Article.

The secretion of the vegetating syphiloderm is contagious; not that it produces vegetations in others than its bearer, but that it carries the syphilitic contagion. The secretion of the vegetating papule will, in other words, produce a chancre when inoculated upon a healthy person.

Although not auto-inoculable, yet the lesions are usually found grouped, and often multiply greatly in the regions favorable to their growth, that is, in those localities where heat and moisture are present with the irritating secretions of other lesions. Want of cleanliness is an important factor in the causation of these lesions. They are usually amenable to local and hygienic treatment employed in addition to the ordinary constitutional measures. (See Local Treatment of Syphilis.)

THE PAPULO-SQUAMOUS SYPHILODERM.[2]—The ordinary papular syphiloderm frequently takes on a scaly character, presenting certain peculiarities which require its separate description. It presents different appearances as it occurs in one locality or another, and according to the arrangement of the lesions. These may be scattered and isolated, or they may be grouped or joined together in diffused patches. They are generally flattened, and are covered with a dry, grayish, adherent scale. This is usually scanty as compared with the scales in psoriasis, which this form of the syphiloderm otherwise closely resembles. If the scales are removed, the papules beneath are seen to be

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[1] For a table showing the comparative frequency of these lesions, see page 508.

[2] This is the affection formerly and very erroneously called "syphilitic psoriasis," a term which used to give rise to much confusion. While the etiology of psoriasis is still unknown, it is quite certain that it is not due to syphilis. The question has been thoroughly discussed and settled by Duhring (Differential Diagnosis between Psoriasis and Syphiloderma Squamosum, Phila. Med. Times, vol. iv., 1873–4; and So-called Psoriasis Syphilitica, ibid.), and the term syphilitic psoriasis is no longer used by dermatologists.

elevated or flattened, of a dull red color, and more or less sharply defined. The eruption is rarely extensive, and is not infrequently composed of a few scattered lesions at wide distances apart.

The palmar and plantar syphiloderm is a variety of the papulo-squamous affection, which is modified by the peculiar structure of the skin in the affected parts. The palms and soles are favorite localities, and here the eruption is apt to prove very persistent. The lesions sometimes look more like macules than papules; they are slightly raised above the surrounding skin, as a rule, ill-defined, and from split-pea to finger-nail sized. Sometimes they coalesce into crescentic or serpiginous and irregular patches. The lesions are usually covered with a thin scale, more abundant about the edge, giving the appearance of a *collerette* (Plate XI. Figs. 1 and 2). If these scales are removed, the surface beneath is seen of a dull red color. Sometimes, especially upon the sole, an abundant formation of epidermis takes place, giving the patch a horny appearance (as seen in some of the lesions depicted in Pl. XI.). At other times the lesions take the form of large pin-head or small pea-sized epithelial concretions, which can be dug out of the skin like the so-called "roots" of corns. This is the *syphilide cornée* of French writers, and when it occurs extensively on the soles, it may prevent locomotion. I recently saw a case where the plantar eruption was extensive, and where the patient described the feeling on walking as if the shoes were filled with hard peas. Occasionally the lesions display no desquamation, but have simply a dull-red erythematous look. In addition to the lesions described, fissures often exist extending deeply into the corium.

The eruption is usually, though by no means always, symmetrical, and is apt to appear upon the centre of the palm or sole, or upon the ball of the thumb or the hollow of the foot. It rarely attacks the backs of the hands or feet, and is usually strictly confined to the palm or sole. Now and then, however, a large patch is found to creep up over the edge of the palm or sole to the skin beyond, the disease commonly extending by a distinctly elevated, crescentic border.

As regards the extent of the eruption, this varies greatly in different cases. Sometimes a single small lesion on one palm or sole may alone exist. In other cases it may be much more extensive, both palms and both soles being covered with the eruption. As a rule, there is neither heat nor itching. The affection is very chronic and persistent; it may last for years, and is often extremely rebellious to treatment. It may be either an early or a late syphilitic manifestation. When it occurs symmetrically, it is usually in the earlier stages; but single, isolated and unilateral eruptions are more commonly of late occurrence, sometimes years after the initial lesion.

The *diagnosis* of the papulo-squamous syphiloderm often presents considerable difficulties, and its various characteristic features should be studied with great care in all doubtful cases.[1] It is liable to be confounded with *eczema*, with *psoriasis*, and on the palm or sole with *callosity*. From eczema it may be distinguished by the absence of heat, itching, and discharge, the two former of which symptoms are almost always present in eczema. The course of the eruption and its history will also often be of assistance in the diagnosis.

In the examination of cases, when the diagnosis lies between the papulo-squamous syphiloderm and psoriasis, the following facts should be borne in

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[1] See an excellent paper by Bulkley, On the Diagnosis and Treatment of Chronic Scaly Eruptions of the Palm of the Hand. New York Med. Record, March 18, 1876.

PLATE XI.
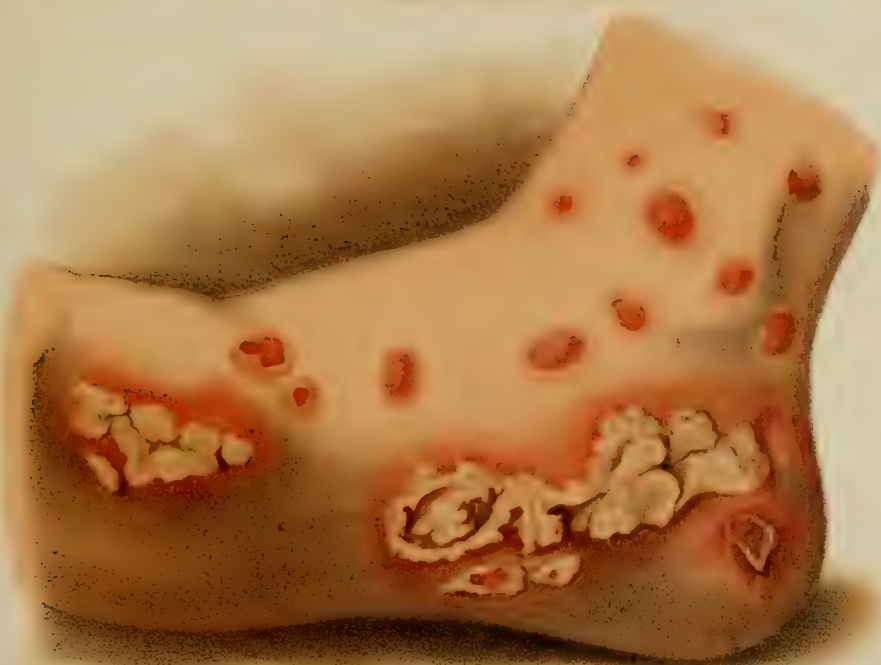
Syphiloderm of palm and sole.

mind. The syphiloderm is almost invariably confined to adult age, and is the result of acquired syphilis; psoriasis frequently manifests itself in early life, before the age of twenty. The history will almost always give some account of antecedent syphilitic symptoms, or, on the other hand, of previous psoriasis. The edges of the patch of syphiloderm are generally elevated, and possess a well-defined line of demarcation, the disease terminating abruptly against the healthy skin. When the scales are removed from a patch of psoriasis, it is seen to be scarcely elevated above the level of the surrounding skin, and not infrequently melts imperceptibly into it. The syphiloderm is not usually symmetrical, while psoriasis is very commonly so. Both syphilis and psoriasis may invade the palms and soles alone, but when psoriasis is encountered in these parts it is apt to be met with on other parts of the body also, particularly on the extensor surfaces of the elbows and knees. Itching is apt to be present in psoriasis; it is rarely present in the syphiloderm, and, when it does exist, is but slight. Psoriasis may extend rapidly; the syphiloderm extends very slowly. The difference in the pathological structure of the lesions is a great help in diagnosis. The syphiloderm being a deeper infiltration and deposit in the skin, gives the appearance of thickness in the tissue of the skin, while in psoriasis the lesions are much more superficial. In psoriasis the epidermic involvement, shown by scaliness, is most obvious; in the syphiloderm it is the base of the lesion which is seen to be the prominent and essential manifestation. The syphiloderm is very apt to be polymorphous, particularly if widespread—some lesions may almost always be found which are characteristic; in psoriasis, on the other hand, the type is preserved in all the lesions wherever they show themselves. Finally, some of the syphilitic lesions are liable to break down, and at one time or another give rise to some sort of ulceration, discharge, and crusting, while psoriasis is a dry disease, always and at all times.

The following table, from Fournier, will give some further information regarding this question of diagnosis:—

DIFFERENTIAL DIAGNOSIS BETWEEN THE PAPULO-SQUAMOUS SYPHILODERM
AND PSORIASIS.

PAPULO-SQUAMOUS SYPHILODERM.	PSORIASIS.
1) Surface of the papule almost always incompletely covered with scales, denuded over a greater or less area. Sometimes simply a *collerette* of scales around the papule.	(1) Surface of the lesion always covered with scales, sometimes quite thickly.
(2) Scales thin, small, transparent, superficial, and of a grayish color.	(2) Scales large, thick, superposed, imbricated, often forming a thick covering, a sort of epidermic shell over the lesion; the individual scales white and pearly.
(3) The eruption is of a dark red, sometimes coppery or ham color.	(3) Color less distinctly red and less deep in tint when the scales are removed.
(4) The skin in the immediate neighborhood of the lesion is rather resistant to the touch than thickened, sometimes resembling the parchment-induration of chancre.	(4) Skin thickened rather than resistant to the touch in the immediate neighborhood of the lesions.
(5) Individual lesions generally small or of medium size; often roundish, circular, or of a contour made up of segments of circles.	(5) Lesions sometimes small, but also frequently large, forming patches of considerable size; presenting to a much less degree a rounded outline.
(6) No characteristic localization except one form, the palmar and plantar.	(6) Characteristic localization, extensor surfaces of elbows and knees.

Papulo-Squamous Syphiloderm.	Psoriasis.
(7) Duration relatively short compared with that of psoriasis.	(7) Duration always long. Frequently a history of persistence since childhood or early youth.
(8) The lesions rapidly disappear under the influence of mercury.	(8) The lesions remain uninfluenced by mercury.
(9) Antecedent or even concomitant syphilitic manifestations.	(9) Antecedent or concomitant syphilitic symptoms only accidental. Frequently a history of arthritic rheumatism.

Vesicular Syphiloderm.[1]

Vesicles are rarely encountered in syphilis, the lesions which commonly show themselves as such in their early stages becoming eventually transformed into pustules. The lesions in typical cases vary in size, form, arrangement, and distribution. They may be small, pin-head sized, more or less acuminated, and disseminated or grouped; or split-pea sized, flat or semi-globular, with or without umbilication. The small miliary vesicles manifest themselves as irregularly grouped or disseminated lesions, inclining to involve the hair follicles, and are succeeded by minute, yellowish, granular crusts. Sometimes the larger vesicles assume a varicella-like appearance and distribution, the lesions being split-pea sized and slightly umbilicated, containing a clear or cloudy fluid, and being surrounded by a reddish areola. They are apt to be peculiarly persistent, lasting for days without undergoing change.

The eruption commonly shows itself in localities where the skin is naturally thin, as upon the face and genitalia. It is rarely extensive, nor are its lesions numerous. Its course is usually rapid, the lesions terminating in rupture and slight crusting. Other lesions, especially papules, coexist. The eruption is early, occurring within the first six months or year of the disease.

Occasionally syphilitic eruptions are met with closely resembling eczema. The following abstract of a case, which I reported several years ago,[2] is of interest, because the eruption resembled eczema in so many respects that, without a history and without the concomitant lesions to guide one, a mistake in diagnosis might readily have been made, and, in fact, was made at first, in spite of these aids.

The patient, a woman of forty, in the seventh year of an attack of syphilis characterized by successive outbreaks of various kinds, presented an affection of the scalp consisting of a hand-sized patch of infiltrated, red, scaly, and crusted disease, pouring out a profuse serous secretion, thick, tenacious, clear, and yellowish in color, which matted the hairs together, and even ran down over the neck. On pulling the hairs apart, or lifting the dried crusts of serum and epidermis, the surface of the skin could be seen, red, raw, and weeping. There was little or no odor from the scalp. The patient complained of some pain in the head, and of severe itching. The affection was mistaken at first for eczema, and treated locally. The patient disappeared for many months, and when she returned again presented unequivocal symptoms of syphilis in connection with the same vesicular eruption, which healed finally under specific treatment.

The Pustular Syphiloderm.

The pustular syphilodermata, although not as common as the erythematous and papular eruptions, constitute a large and important group. They

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[1] The best description of this affection may be found in Bassereau (Affections de la Peau symptomatiques de la Syphilis), and in Hardy (Leçons sur la Scrofule et les Scrofulides et sur la Syphilis et les Syphilides).
[2] Archives of Dermatology, 1876, p. 217.

appear in a variety of forms, the lesions of which differ in size, shape, number, distribution, and other features.

The pustules vary greatly in size, shape, and form. They may be pin-head or finger-nail sized, circular, ovalish, or irregular, acuminated, rounded, or flat. They may be situated on indurated papular bases, or surrounded by an extensive areola, in which case they are but little elevated above the level of the surface. They may be few or numerous, and are apt to be disseminated over the surface without regularity of distribution. From the decided inclination to crust which the larger pustules manifest early in their course, they have been termed "pustulo-crustaceous lesions." The crusts usually begin to form shortly after the lesions manifest themselves, but sometimes they form simultaneously with the pustules. As a rule, the larger the pustule, the sooner will the process of crusting begin.

The crusts vary in color from yellow to brown, or even black, and when of any size and depth incline to assume an olive-greenish hue. Beneath the recent crust there always exists an ulcer. This may be superficial or deep, according to the general character of the primary lesion. The edges are usually sharply defined, giving the lesion a punched-out appearance. The fact of this ulcerative condition existing only in the lesions of syphilis, should be borne in mind when endeavoring to make a diagnosis in doubtful cases. If a doubtful crust is lifted with a pin or other instrument, and an excoriated surface only is found beneath, the chances are in favor of the presence of a non-syphilitic lesion. But if, on lifting the crust, an ulcer is seen with its base covered with an abundant, grayish, yellowish, or greenish, puriform secretion, the lesion is in all probability syphilitic. The pustular lesions are followed by pigmentation, and usually by cicatrices. They may occur early or late in the disease. When early, they are of more serious significance.

THE SMALL ACUMINATED PUSTULAR SYPHILODERM (*Miliary Syphiloderm*).— In this variety of the pustular syphiloderm the pustules are millet-seed sized, raised above the level of the skin, and seated upon minute, reddish, papular elevations, and contain a very small quantity of purulent fluid. When they dry, small yellowish crusts fall off, leaving a slight desquamative exfoliation in the form of a ring, the "collerette" of the French. The hair follicles are commonly involved, the hairs penetrating through the centres of the lesions.

The eruption is usually abundant, the pustules existing in great numbers, discretely or confluently, and irregularly disseminated in groups over various lesions. Sometimes they are arranged in circles or segments of circles. When the eruption appears for the first time it generally covers a large surface, but occurring as a relapse it may be localized. The arms, thighs, chest, and back are favorite localities. Various stages of the eruption, together with large and small papules, and sometimes miliary vesicles, are observed in connection with the lesions under consideration. The miliary pustular syphiloderm may be one of the earliest skin manifestations of syphilis, occurring six weeks after the initial lesion, and accompanied with fever and other general symptoms; or it may be seen as a later though still early manifestation. Relapses may occur, and the lesions as they disappear leave deep pigment stains and pitted depressions which are slowly effaced. The diagnosis is not difficult. The eruption does not usually occur alone, but is generally accompanied by other symptoms of syphilis.[1]

LARGE ACUMINATED PUSTULAR SYPHILODERM.—This is the *acneiform syphiloderm* of some writers, and is characterized by the appearance of pointed

[1] See Duhring's Atlas, Pl. L.

pustules, looking not unlike those of acne and smallpox. The crusts which result from drying up of the pustules are yellowish or brownish-yellow, and are seated upon small superficial ulcers. The eruption may break out rapidly, with fever, or it may develop slowly. In the first case, small red macules appear, which rapidly develop into papules and then pustules, the eruption reaching its full development in from twenty-four to forty-eight hours. In the subacute form papules slowly appear, and upon their summits a small quantity of pus gradually accumulates. In the acute form the lesions are numerous and widely disseminated. In the subacute form the lesions are less numerous, and are more apt to be localized and grouped. They are met with on the scalp, face,[1] and trunk; more rarely upon the extremities. Other syphilitic lesions, such as papules, are apt to be present.

This eruption is one of the earliest of the pustular syphilodermata, and, as a rule, pursues a rapid and benign course. It is apt to be mistaken for *acne* and especially for *smallpox*. The history, however, will easily prevent any mistake being made regarding acne. When fever is present, it is sometimes a little difficult to distinguish between the acneiform syphiloderm and the eruption of variola. The various concomitant symptoms must be carefully inquired into. In the syphilitic eruption, the initial lesion, or some trace of it, can often be found, and glandular engorgement in the groins, and in the epitrochlear and cervical regions, should usually be present. In addition, the well-known polymorphism of syphilis should lead to the careful scanning of the entire cutaneous surface, with the view of finding moist or dry papules, or other unquestionably syphilitic skin lesions, concomitant with the manifestation under investigation. The acneiform syphiloderm is also liable to be confounded with the *eruptions produced by the ingestion of iodide or bromide of potassium*. The pustules of these medicinal eruptions, however, contain cheesy or sebaceous contents quite different from the frankly purulent fluid of the syphiloderm, and the history of the case also assists in the diagnosis.

Sometimes, however, an exact diagnosis of acneiform syphiloderm is difficult, if not impossible, at sight and off-hand, and a few days must be allowed to elapse in order to determine the nature of a questionable eruption.

The Small Flat Pustular Syphiloderm.—This eruption, sometimes called the *impetiginiform syphiloderm*, is made up of small, flat pustules, grouped into an irregularly shaped patch. Crusting begins almost immediately, rendering the lesions markedly pustulo-crustaceous. The crusts are thick, bulky, and more or less adherent; they are of a yellowish-green, or yellowish-brown color, and sometimes coalesce and form a sheet. The ulcer underneath the crust may be superficial or deep.

The eruption is usually met with upon the face, especially about the nose and mouth—on the hairy parts of the face—on the scalp, and about the genitalia. It is generally benign, but may sometimes take on a malignant form with deep ulceration. The impetiginiform syphiloderm may be mistaken for *impetigo* or for *pustular eczema*—the latter especially upon the scalp. On raising the crusts of the syphilitic lesions, ulcers will be found beneath. These are never encountered in eczema, an excoriation alone being seen when the crust is detached in this disease.

The Large Flat Pustular Syphiloderm (*Ecthymatiform Syphiloderm*).— The lesions here are large, finger-nail sized, flat pustules, seated upon a deep red base. They incline to dry up and crust immediately. There are two varieties, the superficial and the deep. The first shows a flat, yellowish-

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[1] See Duhring's Atlas, Pl. v.

brown crust, on a superficial ulcer or erosion. The lesions are numerous, and are usually seated on the back, shoulders, and extremities, though they may occur elsewhere.[1] It generally occurs between the sixth and the twelfth month of the disease, and runs a benign course.

The deep variety possesses a larger, more raised, and bulky crust, sometimes conical, and stratified like an oyster-shell—whence the name *rupia*, which is applied to this lesion as well as to the crusted form of the bullous syphiloderm. Beneath the crust the ulcer is seen to be excavated, deep, punched out, and covered with an unhealthy-looking, greenish-yellow, puriform secretion. The lesions are less numerous than in the first variety, sometimes only three or four being present at any one time. It is a late and usually a malignant manifestation.

TUBERCULAR SYPHILODERM.

The eruption here consists of one or more solid elevations of the skin, varying in size from a split pea to a hazelnut; smooth, glistening, rounded or somewhat pointed, hard, and felt to be deeply seated. Their color varies from a brownish ham color, to a bright red or true copper color. Sometimes they have an intensely smoky-red hue, a color not met with in any other disease of the skin.

They may occur singly or grouped together, but rarely in great numbers. They are apt to be confined to some single region of the body. When in large numbers they are apt to form tubercular patches. They may be irregularly grouped, or arranged in segments of circles.

SERPIGINOUS FORM.—Sometimes a serpiginous tract is thus formed, the eruption being then known as the *serpiginous tubercular syphiloderm,* apt to be a very obstinate form of the disease.[2]

The tubercular syphiloderm is indolent, unaccompanied by any subjective symptoms, and occupying weeks and months in its development. It is a late manifestation, rarely showing itself before the second year, and generally not until later. Not infrequently it does not appear until five, ten, or even twenty years after the initial lesion, and in women, in whom the early symptoms of syphilis are sometimes entirely overlooked or ignored, the diagnosis is occasionally difficult. I have repeatedly met with cases where a single tubercle, the size of a split pea, situated perhaps in the angle of the ala nasi,[3] and resembling to all but the experienced eye a lesion of acne, was the only representative of syphilis. In such cases it is vain to attempt to extract a history. No one is likely to remember the slight "ulcerated sore throat," "fever blisters," or "heat rash," which may have attracted passing attention a dozen years previously. Yet the recognition of some small tubercular lesion will occasionally, perhaps, give the clue to obscure nervous symptoms which might otherwise go unexplained, and perhaps be erroneously treated.

The lesions of the tubercular syphiloderm disappear in one of two ways— by absorption or ulceration. They may ulcerate superficially or deeply, usually the latter, the ulcer being deeply punched-out, horse-shoe shaped, or crescentic, and covered with a grayish-yellow deposit of gummy matter, or with a brownish crust. Ulceration may also attack a patch of grouped

[1] See Duhring's Atlas, Plate D.

[2] See R. W. Taylor on the Serpiginous Tubercular Syphilide. Am. Jour. Syph. and Derm., Jan. 1870.

[3] The illustration in Plate XIII. Fig. 1, gives the characteristics of this lesion in a typical and well-marked case. I refer in the text to the possible occurrence of a single one of such nodules.

tubercles, the result being an extensive excavation, involving at times the whole affected surface. Not infrequently the process assumes a serpiginous course, the ulceration being usually accompanied by a certain amount of simultaneous cicatrization, and it is then apt to be disfiguring in its results. It is often encountered on the back, and is generally obstinate. (Plate XII.)

VEGETATING FORM.—Papillary formations at times spring up from the surface of ulcerating syphilitic tubercles, forming wart-like and cauliflower excrescences, accompanied by a yellowish, puriform, offensive secretion—the *syphilis cutanea papillomatosa.* Many cases of the so-called framboesia of older writers were aggravated instances of this variety of disease. The same form of growth may occur with the gummatous ulcer.

The tubercular syphiloderm is to be diagnosed from lupus vulgaris, from lepra, and from carcinoma. It is most liable to be confounded with lupus vulgaris. The tubercles of syphilis, however, are firmer, more deeply seated, and have a history of more rapid development. Lupus, moreover, appears usually first in childhood, while the tubercular syphiloderm is rarely seen before adult or middle age.

THE GUMMATOUS SYPHILODERM.

Gummata of the integument are usually situated primarily in the sub-cutaneous connective tissue, and only subsequently make their appearance in the true skin. But although denied by some writers, yet true gummatous infiltration of the skin does unquestionably occur, and in a form which is easily to be distinguished clinically from the tubercular syphiloderm, with which it is most apt to be confounded.

The gumma of the skin appears first as a more or less circumscribed formation, in the form of a slightly raised, rounded, or flat tumor, variable as to

Fig. 330.
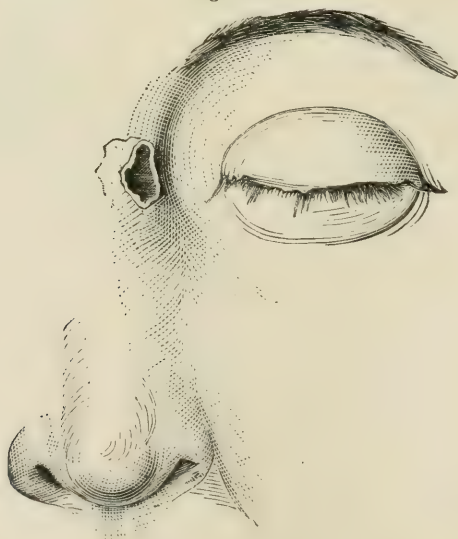
Gumma of the nose.

size, and tending to break down into an ulcer. More commonly, however, it begins in the subcutaneous connective tissue, and is felt as a small-pea sized, ill-defined, painless body, which is felt to be beneath the skin. The latter is

PLATE XII.

Tubercular ulcerating syphiloderm.
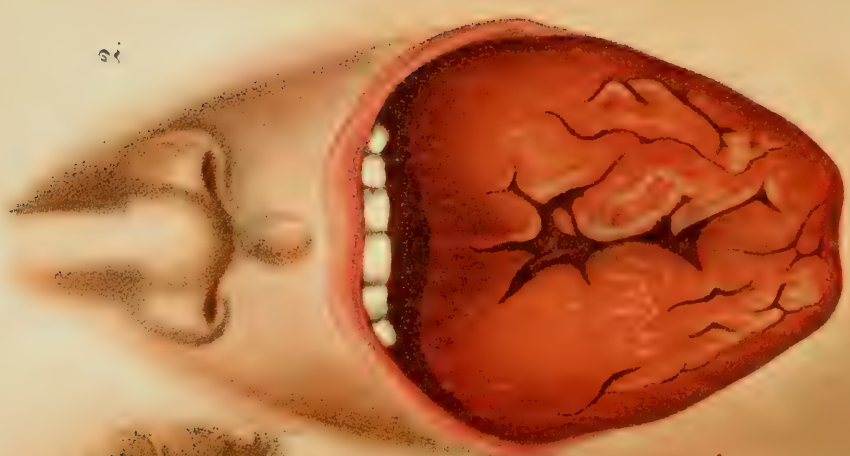
not altered in color, nor is the outline of the growth discernible. The deposit increases slowly in volume, until through a period of weeks or months it gradually assumes definite shape and consistence. It is now seen to be a more or less rounded tumor, imbedded in the subcutaneous tissues, the skin over which becomes pinkish or reddish. In size it may vary from that of a hazelnut to that of a walnut, or even larger, with a slightly elevated semi-globular shape, and with a soft, doughy, somewhat elastic feel.

Gummata are usually solitary, rarely occurring more than one or two at a time. They may occur in any part of the body, but are most commonly met with in the looser and softer tissues, as upon the flexor surface of the extremities, the abdomen, the sides of the thorax, the penis, etc. (Plate XIII. Fig. 3.)

The gumma tends strongly to break down and ulcerate, with destruction of the tissues in which it has its seat. The ulcer is a circumscribed, deep excavation, usually rounded in form, with abrupt, perpendicular edges. It may vary from the size of a finger-nail to that of the hand. Its bottom is uneven, and covered with a grayish-red gummy deposit. The loss of tissue is usually great, but the process of repair leaves often a much less marked cicatrix than would have been predicted. Gummata are occasionally absorbed without ulceration.

The diagnosis of the gumma is usually not difficult. It is to be distinguished from furuncle and from abscess, from enlarged lymphatic glands, from carcinoma, and from fibrous and fatty growths. I think the gumma is more apt to be confounded with abscess than with any other affection. I have often seen gummata which have been mistakenly poulticed until they have broken down into ulcers. This is an unfortunate mistake, as the early administration of iodide of potassium will often put back and cause absorption of the syphiloma, thus shortening the duration of the affection, and in many cases preventing the subsequent formation of a scar. The history of the case, the freedom from pain and febrile reaction in a lesion which to the eye presents the appearance of marked and decided inflammation, as well as the history of its slow and usually painless evolution, will serve to stamp the suspected furuncle or abscess as in reality a gumma.

The gummatous ulcer will be diagnosed from the non-syphilitic ulcer by its history, depth, sharply defined edges, and punched-out appearance;[1] by the character of the secretion; the absence, as a rule, of pain, excepting in gummatous ulcers of the leg, when pain is often present; and the presence, in many cases, of other symptoms of syphilis.

The Bullous Syphiloderm.

The bullous syphiloderm[2] is characterized by blebs containing a clear, watery fluid, which tends soon to become cloudy and thick. At times, indeed, the lesions are more like pustules than blebs. In size they vary from that of a pea to that of a walnut. They are discrete, disseminated, circular or ovalish in form, and surrounded with a slight areola. They may be fully or only partially distended, but after lasting a variable time they break, the contents drying into yellowish, brownish, or dark greenish crusts. These sometimes assume a heaped-up, oyster shell-like appearance which gives rise to the name *rupia*, applied to this eruption as well as the large flat pustular syphiloderm above described. Beneath the crusts are seen erosions or shallow ulcers, which in

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[1] This characteristic is shown in Pl. XIII. Fig. 3.
[2] Formerly, to the confusion of the student, called "syphilitic pemphigus."

healing leave more or less pigmented cicatrices. The course of the eruption is variable, depending upon the condition of the patient's general health.

The bullous syphiloderm is a late eruption, and usually occurs in connection with other syphilitic manifestations. It is rare, and is met with in cachectic, broken-down subjects. It often occurs as the result of hereditary syphilis in the new-born, when it closely resembles pemphigus vulgaris.[1] The character of the blebs, and of the subsequent crusts, will, however, easily serve to distinguish this syphiloderm from pemphigus.

The Pigmentary Syphiloderm.

This eruption, the existence of which has been denied by some observers, is very rare. It has been described (with a chromo-lithographic illustration) in the second edition of Fournier's "Leçons sur la Syphilis," and in this country by G. H. Fox[2] and by J. E. Atkinson.[3] It consists in a more or less circumscribed pigmentation of the skin, in the form of roundish, ovalish, or irregularly shaped, split-pea or finger-nail sized, discrete or confluent macules, on a level with the skin. They are not preceded by hyperæmia, nor do they follow upon the site of other syphilitic lesions. Their color is a pale, yellowish-brown, often so faint as to cause them to present rather the appearance of dirt marks than of lesions in the skin. They are apt to coalesce and form a sort of net-work. There are no subjective symptoms. The affection occurs in the latter half of the first and in the second year of syphilis. Its course is slow, and it is uninfluenced by specific treatment.

Local Treatment of the Syphilodermata.

The general and internal treatment of the syphilodermata is that of syphilis in general, and for this reference may be made to the section on treatment. The local management of these lesions demands, however, some special notice here.

The erythematous syphiloderm does not require local treatment, nor will this, unless in the form of the mercurial vapor-bath, be apt to do much service. The papular syphiloderm likewise does not often require the aid of local applications, excepting when the surface of the lesions is denuded, as in the moist papule, or where they occupy a conspicuous position, as on the face. For the moist papules occurring about the anus or genitalia, especially when accompanied by vegetations, extreme cleanliness, separation of the adjoining parts with dry lint or cloths, and thorough washing with dilute solution of chlorinated soda, may be employed. In connection with these measures, the moist surface of the lesions may be dressed with finely powdered calomel, or anointed with the following ointment:—

> R.—Pulv. hydrarg. chlor. mit. ℥ss.
> Ung. aquæ rosæ, ℥j. M.

The same ointment, well rubbed in, hastens the disappearance of papular lesions on the face.

Great relief may be obtained in the case of pustular eruptions by the early

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[1] See under hereditary infantile syphilis.
[2] Am. Jour. Med. Sci., April, 1876.
[3] The Pigmentary Syphiloderm, a paper read before the American Dermatological Association, at its second annual meeting, 1879, and published in the Chicago Med. Jour. and Exam., Oct. 1879.

removal of the crusts when these begin to form, and by dressing the eroded or ulcerated surfaces with some mildly stimulating ointment, such as that just given, or with the following :—

R.—Hydrarg. ammoniat. ℈j.
Ung. aquæ rosæ, ℥j.　M.

Of course, when the lesions are numerous, local applications are made with difficulty to every part, and must then be confined to such lesions as, from their situation, give rise to much discomfort.　In case of the more discrete and widely scattered pustular eruptions, a warm bath, taken when the crusts are ready to become detached, will loosen them entirely, and then the eroded surface of the lesions may be lightly anointed with some very mild stimulating ointment, such as this:—

R.—Zinci oxidi, ℥ss.
Adipis, ℥iiss.
Sevi, ℥v.
Ol. rosæ, ♏ ij.　M.

The mercurial ointments should not be employed over large surfaces, or on numerous lesions, for fear of absorption.

In the ulcerating tubercular or serpiginous tubercular syphiloderm, I know of no application as useful as iodoform in one shape or another.　Dusted lightly on the surface of the ulcer and covered with a piece of raw cotton, its good effect is often really surprising.　Lesions will often heal up under iodoform with marvellous rapidity.　A good iodoform ointment is this:—

R.—Pulv. iodoformi,
Bals. Peruv. āā ℥ss.
Adipis, ℥iv.　M.

But the penetrating and disgusting odor of iodoform is a serious bar to its employment, and more commonly we must make use of other remedies. Among these, the most generally useful is the black wash of the U. S. Pharmacopœia, and, in some cases, the yellow wash.　These two washes are also useful, particularly the yellow wash, in the treatment of gummatous ulcers. Occasionally these ulcers, as they occur upon the lower extremities, are irritated, inflamed, and painful; under which circumstances rest and soothing applications, such as lead-water cloths or poultices, must be applied first, before the more stimulating applications are brought into play.

Lesions of the Appendages of the Skin.

Onyxis.[1]—Syphilitic affections of the nails may assume several different forms, some of a comparatively trifling character, others much more troublesome.　Occasionally a comparatively ephemeral affection occurs on the nails, chiefly of the fingers and most commonly met with in women, where the nail becomes dry, friable, and fissured, the free portion showing transverse ridges, and the nail breaking and splitting with the least pressure or violence. This is an early manifestation, and it may persist through a considerable period (*onyxis craquelée*, friable onychia).

Another form occasionally met with is *hypertrophic onyxis*.　The nail may assume three or four times its normal thickness, its color changes to a dull

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[1] See Emanuel Kohn, Remarks upon the Pathology and Therapeutics of Syphilitic Diseases of the Nails.　(Wien. med. Presse, Nos. 24, 27, und 28, 1870.)　Translated in Am. Journ. Syph. and Derm., vol. ii., 1871, p. 78.

grayish or yellowish tint, it is covered with rough transverse or longitudinal ridges, and its free border may be bent and horn-like, or it may be thickened and squared off with a rough laminated edge. One or more nails may be affected. Commonly this affection runs a course *pari-passu* with the other early, generalized symptoms, the diseased nail tissue being gradually replaced by healthier structure as the general system recovers its tone under the influence of constitutional treatment. Now and then it runs a slower course, and, being stubborn to both general and local treatment, persists for months after other symptoms have disappeared.

A third form of onyxis is that in which, the matrix being involved, a part or the whole of the nail is detached from its bed, and is gradually separated and shed. Not infrequently the nail is first separated at its root, and is then carried gradually forward, leaving the rough and hardened matrix imperfectly covered with a corneous growth behind. Regeneration gradually takes place, and in time, with the improvement of the general health under treatment, a healthy nail takes the place of the diseased one.

None of the affections of the nails above described are painful, and they are important chiefly on account of the deformity to which they give rise, and as indicative of the general state of the system.

PERIONYXIS.—When a syphilitic papule is developed in the cutaneous fold bordering the nail, the hypertrophied epidermis becomes fissured and more or less horny, and exfoliates, forming a sort of dry, squamous perionyxis which is painless, and which, although extremely persistent, gives no trouble unless picked and irritated by the patient, when it may develop ulceration. Another form of perionyxis begins by a peri-ungual swelling like an ordinary " run-around;" the extremity of the member becomes more or less enlarged, and of a dull currant or coppery color. The process, which is a sub-inflammatory one, goes on slowly and without pain, in this respect differing from the acute, painful course of the " run-around." It never terminates in an abscess, usually ending in resolution, but sometimes ulcerates superficially, forming ulcerative perionyxis.

Ulcerative perionyxis is characterized by a loss of substance of variable extent and degree, affecting the border, sides, or free extremity of the nail, or pulp of the member. The ulcer has an unhealthy aspect, being covered with sanious sanguinolent pus, and the swollen tissues in the neighborhood are dusky and more or less livid. This form of perionyxis when occurring in the toes is easily confounded with ingrowing toe-nail, but the extent of the swelling, its indolent character, and the extension of the ulceration serve to mark the syphilitic character of the lesion. The perionyxis may be complicated by onyxis, the nail separating entirely or in part, and the member becoming greatly enlarged, and covered with ulcerating and fungous granulations. After a considerable period, reparation takes place, with the entire or partial restitution of the nail, which is rarely normal in appearance; or, when the matrix has been nearly destroyed, a rough, hard, knobby surface remains in place of the normal nail.

The treatment of the dry form of onyxis and of perionyxis is the general treatment of the early stage of syphilis. The inflammatory form is best treated by occlusion with the Emplastrum de Vigo,[1] and by use of the ordinary

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[1] The Emplastrum de Vigo, formerly extensively employed, is composed of lead plaster, 2 lbs. 8 oz.; yellow wax and resin, each 2 oz.; ammoniac, bdellium, olibanum, and myrrh, each 5 dr.; saffron, 3 dr.; mercury, 12 oz.; turpentine, 2 oz.; liquid storax, 6 oz.; oil of lavender, 2 dr. The gum, resin, and saffron to be powdered, the mercury to be rubbed with the storax and turpentine in an iron mortar until completely extinguished. The plaster then to be melted with the wax and resin, and the powders and volatile oil added to the mixture. When the plaster has

antiphlogistics. When the ulceration is once established it is exceedingly difficult to obtain a cure. Jullien says it is "one of the most embarrassing problems of therapeutics," and my own experience entirely confirms this opinion. Among the remedies most likely to give a satisfactory result may be mentioned the twenty per cent. solution of nitrate of silver (argenti nitrat. gr. c, aquæ f℥j). Small pledgets of lint soaked in this solution are inserted into the ulcerated cavities (Diday). Fournier recommends powdered iodoform, and Vanzetti of Padua powdered nitrate of lead. Camphor and alum is another topical application which has been suggested. Bumstead and Taylor advise the use of strong solutions of caustic potassa (℈j–iv to f℥j) to repress the profuse granulations of the matrix. They also suggest prolonged immersion of the member in very warm water containing powdered borax (℈ij–Oj), to diminish the swelling and remove the secretions. Gradual pressure, carefully applied, may sometimes be advantageously used, and soothing ointments, such as that of belladonna, or Goulard's cerate, may be required in inflammatory cases. The most assiduous cleanliness is required, and the various applications named, as well as others which may suggest themselves, should be essayed in turn when the case is rebellious.[1]

ALOPECIA.—Falling of the hair may occur, without any special lesion of the integument, as a result of perverted nutrition caused by the syphilitic poison. The hair becomes dull, tarnished, and dry-looking, and the patient, as Diday says, looks as if he wore a wig. The least effort brings out the hair "by the handful." A very common seat of alopecia of this variety is the eyebrow, a segment of which is often denuded completely of hair. This alopecia of the eyebrow is regarded by Fournier as pathognomonic of syphilis, even when met with alone. Sometimes general alopecia occurs, involving not only the scalp, but the eyebrows, eyelashes, beard, pubes, etc. But even when the scalp has become almost bald under the influence of the syphilitic disease,[2] complete restitution of its normal covering may be hoped for if the general condition improves under the influence of specific treatment, and the same is the case with this form of alopecia occurring elsewhere. In spite of the current notion, more prevalent, however, in Europe, where the popular knowledge of syphilis is more general if not more accurate, than in America, that premature baldness is due to syphilis, this is not at all the case. Syphilitic alopecia, of the form just described, is the most curable variety of the affection.

Another form of syphilitic alopecia is that caused by syphilitic eruptions of the scalp. Acneiform or pustular lesions of this region are not uncommon, even in the earlier periods of the disease, so that one of the commonest ques-

cooled, but while still liquid, the mercurial mixture to be thoroughly incorporated. This is now superseded for general use by the emplastrum ammoniaci cum hydrargyro of the U. S. Pharmacopœia. The mixture of diachylon with mercurial ointment is, in Bumstead and Taylor's opinion, smoother and more efficient than either the ordinary mercurial plaster or the Emplastrum de Vigo.

[1] See Victor de Méric, Syphilitic Affections of the Nails (Brit. Med. Journ., 1865, p. 45); Betz, Treatment of Syphilitic Perionyxis by Occlusion (Giorn. Ital. delle Mal. Ven., 1868, t. ii. p. 180); Delattre, Treatment of Onyxis (Giorn. Ital. delle Mal. Ven., 1868, t. ii. p. 370); Em. Kohn, Zur Pathologie und Therapie der syphilitischer Nagelerkrankungen (Wien. med. Presse, 1870, xi., 24, 27, 28); Diday, Traitement du Perionyxis Ulcéreux (Annales de Dermatologie et de Syph., 1871, t. iii. p. 182); Fournier, De l'Alopécie, de l'Onyxis et du Perionyxis comme accidents de la Période Secondaire de la Syphilis (Annales de Dermatologie et de Syph., 1871, t. iii. p. 12); Bergh, Syphilitic Affections of the Nails (Hosp. Tidend., 1880, vii., Nos. 46, 47. Abstract in Archives of Dermatology, vol. vii., 1881, p. 336); Hutchinson, Diseases of the Nails (Med. Times and Gaz., April 20, 1878).

[2] Fournier tells of a patient who, at one period of his alopecia, could boast of but seventeen hairs upon his entire head.

tions asked of a patient from whom it is desired to elicit a history of syphilis is, "have you ever had crusts or scabs on the scalp, or falling of the hair?" Papular and pustular eruptions may indeed give rise to alopecia, but this variety, like the first mentioned, is only temporary, the hairs being renewed when the lesions are cured, excepting in those cases of pustular eruptions where the hair follicles may have been destroyed.

A third variety of alopecia occurring in the course of syphilis is that met with late in the disease, when ulceration of the scalp has occurred with destruction of the follicles. This variety is, of course, irremediable.

Syphilitic alopecia requires nothing more than the usual constitutional remedies in order to cure it completely; nevertheless, for the purpose of quieting the patient's mind, and also, perhaps, to hasten a return to the normal condition, certain topical applications may be employed with advantage.[1] The following is a good tonic hair wash:—

R.—Tinct. cantharidis, f℥v.
Tinct. capsici, f℥ij.
Ol. ricini, f℥v.
Aq. cologniensis, ad f℥iv.—M.

In some cases this pomade may be more conveniently employed.

R.—Medullæ bovis, ℥ss.
Tinct. cantharidis, ℳxx.
Hydrarg. chlor. corros. gr. ss.
Ol. rosæ, ℳij.—M.

Syphilis of the Mucous Membranes.[2]

The term *mucous patch* is sometimes used indiscriminately to designate both syphilitic lesions, other than ulcers, occurring on mucous membranes, and also moist papules of the cutaneous or muco-cutaneous surface. Although there is a strong similarity in many respects between certain syphilitic lesions of the external integument and those of the mucous membranes, yet for convenience's sake I have chosen to consider them under distinct heads, giving the name *moist papule* to the lesion of the general integument (see description of the Large Papular Syphiloderm), and reserving the name mucous patch for the lesion as found upon the mucous membranes.

The Seat of Moist Papules and Mucous Patches.

The statistics of Davasse and Deville[3] show that in 186 women these lesions were seated:—

Upon the vulva in	174 cases.
About the anus	59 "
On the perineum	40 "
On the buttocks and the inner and upper aspect of the thighs	38 "
On the tonsils	19 "
On the nose	8 "
On the tongue	6 "
About the toes	5 "

[1] For further information, see: Dulaurier, Alopécie; guérison par les Préparations Mercurielles (Gaz. des Hôp., 1864, p. 310); Donet, Syphilis Constitutionelle; Alopécie (Gaz. des Hôp., 1864, p. 259); Fournier, De l'Alopécie, de l'Onyxis et du Perionyxis comme accidents de la Période Sécondaire de la Syphilis (Annales de Dermatologie et de Syph., t. iii., 1871, p. 12). See, also, Fournier, Leçons, etc., 2e éd., p. 347.

[2] For further description of the various lesions of the mucous membranes, especially the later ones, see Syphilis of the Digestive Tube, etc.

[3] Des Plaques Muqueuses. Archives Gén. de Méd., 1845.

Bassereau's statistics show that in 130 men these lesions were observed:—

About the anus in	110 cases
On the tonsils	100 "
On the scrotum	66 "
On the mouth and lips	55 "
On the glans and internal surface of the pre-puce	28 "
On the velum palati	27 "
On the tongue	18 "
On the half arches	17 "
On the internal aspect of the cheeks and lips	11 "
In the interdigital spaces of the feet	11 "

The mucous patch, like its counterpart, the moist papule, is one of the most important lesions in the entire series of syphilitic manifestations, not only because of its extremely contagious character, but also because of the frequency of its occurrence. Many persons who contract syphilis escape the severer skin eruptions, and the grave, late manifestations, but scarcely any, if, indeed, any at all, escape mucous patches in some shape, or at some period of the early development of the disease. Indeed, as Jullien remarks, the history of an average case of syphilis may be summarized as follows: a chancre, a transitory erythematous rash, and, following this, *mucous patches, relapses of mucous patches, more mucous patches!*

Mucous patches occur and recur without regard to other manifestations, which may come and go, be present or absent, without influencing the course of the mucous lesions. The secretion of the mucous patch is, as has been said, in a high degree contagious. Next to chancre, the mucous patch is the commonest source of infection.[1]

The most frequent seat of mucous patches in men is within the mouth, while in women these lesions are more commonly found upon the vulva. Their development within the mouth is favored by the use of tobacco, either by smoking or chewing, while in all regions uncleanliness is both an inciting cause and a means of keeping the lesions in existence. Mucous patches within the genital organs of both sexes sometimes give rise to a discharge from the neighboring mucous membrane, resembling gonorrhœa, which is not infrequently observed about the time that early secondary symptoms appear, or when a relapse of general symptoms takes place.[2]

Mucous patches within the buccal cavity present the appearance of grayish-white, irregular patches, not elevated, or sometimes depressed below the surface, looking as though they had been pencilled over with nitrate of silver (whence the name " opaline patches," by which they are sometimes known). The most common seat of these lesions is upon the internal surface of the lips and cheeks (Plate X. Fig. 2), upon the tongue (Plate X. Fig. 3), upon the gums, tonsils, and soft palate. They sometimes extend beyond the pillars of the fauces, and are seen upon the walls of the pharynx and the posterior nares. They have also been seen upon the epiglottis and mucous membrane of the larynx.[3]

When mucous patches occur near the angle of the mouth, they often extend into the muco-cutaneous structures at the commissure of the lips, where they form cracks and fissures which possess the characteristic pearly-gray color of these lesions, and where they are often continuous with a patch of the small flat papular or pustular syphiloderm. On the dorsum of the tongue their base is sometimes hard, indurated, and fissured; or the pellicle which covers them

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[1] See above under Sources of Syphilitic Contagion.
[2] Bumstead and Taylor.   [3] Ibid.

may be rubbed off by the attrition of the food, when a slightly depressed, smooth, red surface remains. Vegetations may occasionally form in this locality, as in the case of moist papules on the integument. These, in my experience, are much more rebellious to local treatment than the ordinary mucous patches occurring in this locality. Mucous patches upon the tonsils are peculiarly exposed to irritation, and are often very difficult to heal. Sometimes they develop into ulcers, attended by considerable inflammation and swelling of the surrounding parts, which may at times obscure the original lesion and render it difficult of diagnosis. Deglutition may be considerably impeded, and the swelling may close the Eustachian tube and produce more or less complete, temporary deafness. The neighboring lymphatic glands are sometimes sympathetically enlarged when the mucous patches are inflamed.

The earliest appearance of mucous patches is on the twentieth day after contagion; the usual period for the first appearance of the lesions is from one to two months after contagion, although they may not appear for five or six months after this period. The early administration of mercury delays the appearance of mucous patches sometimes to eighteen months. Their reappearance at a later period in the history of the disease is one of the most certain signs of the renewed activity of the virus.

Treatment.—Mucous patches invariably demand local as well as general treatment. When they occur within the female genitalia, astringent and detergent injections, such as the decoction of oak-bark or Labarraque's solution, are useful. Pencilling with nitrate of silver may also be required. For mucous patches of the mouth, pencilling with nitrate of silver, in stick or solution, should be frequently practised, and the following mouth-wash may be employed:—

> Powdered chlorate of potassium, ℥j.
> " Eau de Botot," f℥iv.
> Use a teaspoonful in a wineglass of water, as a gargle, four or five times daily.

It is hardly necessary to add that the most scrupulous attention to cleanliness is demanded, and, in case of mucous patches of the mouth, the use of tobacco must be strictly forbidden. The tobacco-chewer, in particular, is apt to keep his mucous patches indefinitely. I always insist upon the abandonment of this mode of using tobacco, and decline to treat the case without a pledge that my directions in this matter will be complied with.

Syphilis of the Cellular Tissue; Gummatous Tumors.

Something has already been said about the gummata in dealing with the syphilitic affections of the skin, and some further remarks on the nature of these tumors will be made further on when describing the various lesions of the viscera. It may be repeated now, however, that the chief seat of the gumma is in the connective tissue wherever found.

The name gumma is given to those small tumors which contain at one period or another of their existence a thick gummy fluid. They are among the later lesions of syphilis. Their appearance differs somewhat, according to the region attacked. At the outset, gummata of the subcutaneous connective tissue present themselves in the form of grouped or isolated tumors of small size, rolling under the finger, roundish, hard, and completely indolent. After a time they lose their mobility, and become adherent to the superjacent skin, which in its turn gradually becomes involved. The tumor now softens in the centre, and the skin covering it begins to change, becomes red in color,

softens, and is finally perforated. The gumma may remain in a fluctuating condition for some time without opening. When it does open, if this is early, the escaping fluid is clear, viscid, and gummy. If the tumor does not open for a long time, the fluid discharged is more apt to be sanious and fetid, or purulent. The opening is smaller than the cavity of the abscess formed, and the bottom of the tumor retains its firmness and induration—at times an important point in diagnosis.[1]

The ulcer succeeding the gummatous tumor is roundish, excavated, and surrounded by a dusky red areola. When a number of tumors have been grouped together or agglomerated, the resulting ulcers may unite, forming a large and very irregular sore, with numerous perforations, the openings of deeper gummata. The floor of the gummatous ulcer is generally covered with a peculiar, whitish, putrid layer of débris of characteristic appearance.

When a gumma heals, it leaves behind a roundish, hollowed, white cicatrix, surrounded by an areola of pigment, which gradually disappears.

In addition to these general characteristics of gummata, they possess special peculiarities dependent upon the locality in which they occur, and which will be noted in describing the lesions of the various organs. Occasionally the growth of gummata may cause pressure upon some important part, and thus arouse functional disturbance.

Gummata are not infrequently accompanied by other syphilitic manifestations, such as the severer syphilodermata; and not infrequently by lesions of the bones and viscera—exostoses, syphilitic sarcocele, etc.

The commonest localities for the occurrence of gummata are the face and scalp, the external surface of the limbs, the posterior portion of the shoulder, the attachment of the sterno-mastoid to the sternum, various parts of the mouth, the isthmus of the fauces, and, among the viscera, the testicles and the mammæ.

Though sometimes single, gummata are more frequently found in groups. They may indeed be very numerous, more than 150 lesions having been counted on a single patient.

The gumma is, as has been said, a late lesion, never occurring previous to the sixth month, and sometimes not for years after the initial lesion. Cases have been reported where the first recognized symptom of hereditary syphilis has been the appearance of a gumma thirty years after the patient's birth.

The course of the gumma is naturally very slow; it may remain stationary for months, at any period of its development. No other syphilitic lesion is so rapidly influenced and modified by treatment.

DIAGNOSIS.—The diagnosis of gummata sometimes offers considerable difficulty, especially when the tumors are deeply seated; treatment is in doubtful cases often the only touchstone, and will decide the question with certainty. When the gumma is situated in the subcutaneous cellular tissue, or in the submucous cellular tissue of the buccal cavity or upper part of the pharynx, the objective signs usually suffice to establish the diagnosis. When concomitant syphilitic symptoms are present, it is easy to make out the character of the lesion. When these are absent, and above all when the gumma is solitary, some difficulty may be met with. The not yet softened gumma may be recognized by its rounded form, its firmness, its invariably moderate size, and its indolence. The seat of the tumor, its mobility, and the absence of ganglionic involvement, must also be taken into account. While these characteristics are met with in other than syphilitic tumors, they are rarely so well marked.

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[1] See illustration of gumma of the penis, Pl. XIII. Fig. 3.

Gumma of the mamma may be mistaken for adenoid tumor. The symptoms and course of the two forms of tumor are much the same, and it is difficult to distinguish between them. The touchstone of treatment here comes into play, and will decide the question. Much as I dislike this resource of weakness in syphilitic cases, yet I know not how else, oftentimes, the diagnosis can be settled. It is far different in the syphilitic skin manifestations. To fly to mercury and iodine for the purpose of settling the nature of a doubtful skin disease, is to take the ready refuge of ignorance and incompetency.

It is oftentimes difficult to distinguish between gummata of certain regions—as the tongue, isthmus of the fauces, and penis—and cancer of those parts. When suppuration has once begun, the gumma is unlikely to be mistaken for any other affection excepting chronic abscess, and particularly scrofulous abscess. The scrofulous abscess, however, has not as long a period of incubation as the gumma, and, when it breaks down, suppuration takes place at all points, the resulting ulcer having everted edges rather than the undermined edge of the gummatous ulcer. The age of the patient and the seat of the affection also bear upon the diagnosis.

The gummatous ulcer is distinguished from the scrofulous ulcer, for which it is most likely to be mistaken, by the fact that the latter shows itself chiefly upon the face and neck in young subjects. Its edges are everted and violaceous; the pus which bathes its surface is gummy and caseous, and the cicatrix which succeeds the ulcer is prominent and keloid-like. In addition, the concomitant enlargement of the lymphatic glands in the case of scrofula, and the general appearance, are to be borne in mind.

PROGNOSIS.—The prognosis of gumma is always grave, for its presence signifies the tenacity and persistency of the syphilitic virus in the system. It is often accompanied indeed with more or less marked debility.

TREATMENT.—Iodide of potassium is the great remedy against gummata. It should be given in large doses, often even to the amount of a drachm or a drachm and a half daily. When the constitution is debilitated, tonics, such as cod-liver oil, iron, and quinine, should be given freely, as well as nourishing food, and, in properly-selected cases, stimulants. *A gumma which has not opened should never be poulticed or cut into, even when fluctuation has set in.* This is a golden rule, unfortunately too often broken by practitioners who fail to make a correct diagnosis, and who fancy that they have to deal with some sort of an abscess, or by surgeons who cannot resist the impulse to drive a bistoury into any fluctuating tumor which may present itself. Gummatous tumors can often be resolved, even at the last moment and when fluctuation can be distinctly felt, under proper treatment.

When a gummatous abscess has actually formed, various local applications may be employed. Tincture of iodine, pure or mixed with water, black wash or yellow wash, or one of the mercurial ointments, may be employed. Now and then the detergent influence of chlorinated soda may be brought into action.

It may be said, finally, that now and then the iodide of potassium treatment, which is successful in the vast majority of cases, fails. In this case, mercury can be joined to it or used alone. Sometimes an entire suspension of antisyphilitic treatment for a time seems to do good.

SYPHILIS OF THE ALIMENTARY TRACT.

MOUTH.—The mouth is almost invariably the seat of some syphilitic lesion, at one time or another in the course of the disease, and various lesions may occur in this locality, from the most superficial to the most profound.

Chancre, as has been stated, may occur about the mouth, being most commonly met with upon the lower lip, and being also encountered upon the tongue or tonsils, and, more rarely, upon the internal surface of the cheek, the gums, or the uvula.

Under the name of *acute syphilitic angina*, an erythematous efflorescence has been described, which occurs simultaneously with the earliest generalized manifestations of syphilis, appearing upon the palate, tonsils, and pharynx, as a diffuse redness with slight infiltration of the mucous membrane, and followed by the occasional formation of minute follicular abscesses. Associated with this condition there is often a general œdema, especially of the velum and uvula. The uvula is sometimes greatly swollen, but neither under such circumstances, nor even when it has become considerably eroded by later ulcerative lesions, should it be removed, since nature carries out a better system of repair spontaneously. Acute syphilitic angina cannot be distinguished from simple sore throat, except by the aid of the history or concomitant symptoms of the disease.[1]

Mucous patches, and the slighter ulcerative lesions of the mucous membrane of the buccal cavity, have been described under the head of lesions of the mucous membranes.[2] It may be noted in passing that mucous patches are not found upon the walls of the pharynx, a curious fact which is explained by the theory that as these lesions chiefly affect the papillary layer of the mucous membrane, the absence or ill-development of papillæ in the pharynx accounts for their absence in that locality. The subjective symptoms to which mucous patches of the mouth give rise are almost *nil*, causing the patient oftentimes to be unaware of their presence. When, however, ulceration takes place, particularly about the tonsils, this may be quite extensive even when only superficial in character; it may give rise to great discomfort, and, when situated about the tonsils, to considerable difficulty in deglutition.

The deeper syphilitic ulcers which are met with in the bucco-pharyngeal cavity occur either spontaneously, or as following and resulting from gummata, submucous tubercles, or osseous lesions. These ulcers are indolent, with a sharply defined, punched-out appearance, and with a dull, dusky base covered with grayish deposit. They are commonly limited in extent and do not tend to spread, but occasionally they take on phagedænic action and effect the most frightful ravages. A case has been reported where one of these ulcers penetrated to the lingual artery, requiring ligation of the primitive carotid to save life. Necrosis of the underlying bone occurs, at times, when the ulcer is situated in the pharynx or over the hard palate, communication sometimes being established between the nose and mouth, in the latter case, by this means.

Treatment.—The local treatment of the more superficial syphilitic lesions of the buccal mucous membrane is essentially that described under the head of syphilis of the mucous membranes. Something more, however, may be here added. The two customary caustics employed are nitrate of silver, either in stick or in solution, and acid nitrate of mercury. The second is preferable,

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[1] See Martellière, De l'Angine Syphilitique. Thèse de Paris, 1854.
[2] See, also, Kaposi, Die Syphilis der Haut und der angrenzenden Schleimhäute. Wien, 1881. Neue (unveränderte) Ausgabe.

not only because less superficial and more thorough than the nitrate of silver, but because it does not leave a black stain as the silver application does. The latter is a matter of some moment to patients who may have a visible lesion, as a mucous patch of the commissure of the lips. Nitrate of mercury has one fault, however—it gives rise to pain and swelling; but these can be avoided by due caution in its application.

Caustics should not be applied to the bucco-pharyngeal mucous membrane without due precautions. The affected surface should first be dried, as otherwise the caustic will flow in all directions. Solutions should never be applied by means of a glass rod. A case of death has been reported, occurring from spasm of the larynx induced by a drop of nitrate-of-silver solution let fall during cauterization of the pharynx. The solid stick is less dangerous. Though not to be recommended for use in the pharynx, yet if employed, only a short piece should be used, as of course the quantity swallowed in case of accident would be less. For caustic solutions, a bit of soft pine wood, or a carefully moistened camel's hair pencil, is the best applicator.

The deeper lesions, when not phagedænic, are best treated by cleanliness and dependence upon internal treatment, iodide of potassium having peculiar efficacy in these cases. When a disposition to phagedænic action shows itself, caustics may be employed in addition, but the internal treatment must also be strongly pushed.

Tongue.—The *tongue* is the seat of various syphilitic lesions which in this locality present certain peculiarities worthy of notice. In the earlier stages of the disease, an erythematous rash is sometimes though rarely encountered, showing itself in the form of a group of roundish red patches surrounded by a border of desquamating epithelium. A form of syphilitic papule is another rare lesion, which, however, is occasionally met with upon the tongue. It assumes the appearance of a slight elevation, covered with dull epithelium which gives it a whitish color. The mucous patch is a very common syphilitic lesion of the tongue. In one variety it usually occupies the median portion of the dorsal surface, in the form of an erosion, a smooth, red, rounded patch deprived of its papillæ, and of a polished aspect. In a more advanced stage of evolution this erosive patch is papular and mammillated, owing to hypertrophy of the papillary layer of the derm. Its color is still bright red, and its surface smooth and polished; it may grow to the size of a cherry or almond pit, disfiguring the surface of the tongue.

Syphilitic patches on the tongue may be distinguished from somewhat similar lesions, as follows :—

Chancre.—Solitary lesion; induration; edges of a frankly inflammatory red color; deep ulceration, the bottom often covered with false membrane, and, at a later period, with exuberant granulations; submaxillary adenitis.

Aphthæ.—Slight ulcers, with irregular borders, without induration, often covered with denuded epithelium on which a yellowish lactescent fluid can be observed; lesion rarely isolated; usually painful when ulcerated.

Ulcero-membranous Stomatitis.—A rare affection, particularly upon the tongue; coincidence of ulceration on the gums, the internal surface of the cheeks, and the lips; fungous and pultaceous condition of the base of the ulcer, swelling of adjacent parts; frequent localization on one side of the mouth; frequent and considerable development of painful ganglia corresponding to the lesion.

Another variety of lesion, not infrequently found upon the tongue, is that known by the barbarous name of "buccal psoriasis."[1] It is more apt to be found on the side of the tongue. In its earlier stages, this variety of the

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[1] This name is given to non-syphilitic lesions of the tongue as well. It is confusing, and should be abandoned.

mucous patch may give rise to considerable swelling and œdema, while at a later period it assumes a hard, gristly appearance, and becomes exceedingly intractable to treatment, sometimes lasting a very long time without change.[1]

The later syphilitic lesions of the tongue are of two distinct varieties, called by Fournier[2] *sclerous glossitis* and *gummatous glossitis*. Both varieties are much commoner among men than among women. They generally make their appearance between the fifth and the twelfth year of the syphilitic disease, although now and then they may appear as early as the second, or as late as the fifteenth or even the twentieth year. They usually affect the dorsal surface of the tongue.

Sclerous glossitis may be either superficial, characterized by induration in small or large patches, involving only the upper layer of the mucous membrane, and having a sombre red tint, with a smooth depapillated surface; or it may be deep ("lingual sclerosis," "lobulated glossitis"), characterized by cellular hyperplasia extending to the parenchyma of the tongue, and characterized by tumefaction, mammillation and lobulation of the dorsal surface of the organ, deep induration of the affected parts, with fissuring, together with various alterations of the mucous membrane covering them.[3]

Gummatous glossitis occurs in two varieties, according as the mucous membrane or the submucous and muscular tissues of the tongue are attacked. The former of these begins in the form of pin-head or pea-sized indurations, situated superficially in the mucous membrane of the tongue, hardly perceptible to the sight, but firm to the touch. After a time these little nodules slowly break down and form ulcers, which are peculiarly deep and sharply cut, as if with a small punch. The deep or muscular gumma of the tongue is chiefly distinguished from the former variety by its size (from pea to almond, or even date size), and by the fact that it clearly involves the muscular tissues of the tongue. When it breaks down it leaves a large, deep, well-marked ulcer, usually on the dorsum of the tongue.

The diagnosis of late syphilitic glossitis of whatever kind does not usually offer any great difficulties. Chancre, "psoriasis buccalis," or "lingualis," smokers' glossitis, dental glossitis, and tuberculous glossitis, can usually be distinguished without much difficulty. With cancer of the tongue, however, some difficulty may arise. The history, if carefully obtained, will in this case be of considerable value.

The following Table is given by Fournier to show the differential diagnosis between ulcerative cancer and ulcerative gumma of the tongue :—

ULCERATIVE CANCER OF THE TONGUE.	ULCERATIVE GUMMA OF THE TONGUE.
1. Affection of mature age, maximum frequency between 50 and 70 years.	1. May occur at any age after puberty. Generally observed at an earlier age than cancer.
2. Predisposing cause, hereditary tendency. No syphilitic antecedents excepting by chance.	2. Syphilitic antecedents. No antecedent cancer excepting by chance.
3. Frequent antecedents of "lingual psoriasis."	3. No antecedents of "lingual psoriasis."

[1] A representation of this lesion is given in Plate X. Fig. 3. See also Debove, Psoriasis Buccal, Thèse de Paris, 1873 ; and Mauriac, Du Psoriasis de la Langue et de la Muqueuse Buccale, Paris, 1875, for a fuller description of these lesions, especially from a diagnostic point of view.

[2] Des Glossites Tertiaires. Avec trois planches en chromolithographie. Paris, 1877. An excellent monograph.

[3] The deep form of sclerous glossitis is represented in Plate XIII. Fig. 3.

ULCERATIVE CANCER OF THE TONGUE.	ULCERATIVE GUMMA OF THE TONGUE.
4. Begins by the appearance of a hard superficial nodule, an *external* tumor ; then more or less rapid ulceration of the surface. No opening or evacuation as of an abscess at the beginning of the ulcer ; no excavation.	4. Begins by a hard *internal* nodule ; then sudden opening as of an abscess ; a cavern at first, then rapid ulceration, displaying the mammillated bottom of the tumor.
5. Lesion always *single* and *unilateral,* with rare exceptions.	5. Lesion sometimes *multiple* and *bilateral.*
6. May occupy the inferior aspect of the tongue.	6. Is localized exclusively upon the superior surface and edge of the tongue ; never affects the lower surface.
7. Lesion made up of a tumor, the superficial portion of which is ulcerated.	7. Lesion made up of an ulceration without a true tumor, in the proper acceptation of the word.
8. Edges in relief, forming a raised border, irregular, everted, notched, etc.	8. Excavated, sharply-cut edges, smooth and defined.
9. Surface bleeding easily at the slightest touch.	9. Bottom irregular and not bleeding.
10. Secretion abundant, becoming in the advanced stage fetid and ichorous.	10. Secretion relatively scanty and not ichorous.
11. The ulcer spontaneously painful, lancinating. Occasionally radiating pains towards the ear.	11. Ulcer not spontaneously painful, not lancinating.
12. Functional troubles always marked and sometimes extreme ; immobilization of the tongue ; difficulty of speech, of mastication, of deglutition ; salivation, etc.	12. Functional disturbances very much less marked than in cancer. Tongue not immobilized as in cancer—at least not to the same degree.
13. Lesion leading gradually, after a given time, to general symptoms of cachexia.	13. The lesion itself does not give rise to cachexia.
14. Anatomical examination reveals the characters of epithelioma.	14. Anatomical examination reveals the characters of degenerated gummatous hyperplasia.
15. Ganglia affected after a certain period.	15. Ganglia intact.
16. Anti-syphilitic treatment is without benefit, or even injurious.	16. Anti-syphilitic treatment produces a beneficial effect.

Treatment.—The treatment of the more superficial and early forms of syphilis of the tongue is that of early syphilis in general, mercury holding the most important place. The later affections, and in particular deep sclerous glossitis and gummatous glossitis, require iodide of potassium for their successful management. Local treatment is important. It comprises cleanliness and various topical applications. In the case of the superficial lesions, astringent gargles containing chlorate of potassium (as mentioned under the head of mucous patches), together with stimulating applications, as of the nitrate-of-silver stick lightly touched upon the part, will be found most satisfactory. But for the later lesions these must be laid aside: chlorate of potassium, alum, borax, etc., are here all useless, as are also mercurial gargles, which, indeed, are sometimes positively harmful. Mucilaginous washes are most soothing and grateful. Decoction of marsh-mallow—not gargled hastily, but allowed to remain in the mouth at least five minutes, and repeated twenty or thirty times a day—will be found to give much relief to the patient, and to hasten the cure. Emollient douches of marsh-mallow decoction serve to keep the surface clean and pure in the ulcerative forms of the disease, and the atomization of warm emollient decoctions, and, in

rebellious cases, of a solution of iodide of potassium, ten grains to the ounce, is attended with the happiest results.

Cauterization must be employed in the sclerosed variety with precaution, and not, as is too frequently done, promiscuously. The fissures and raw surfaces may be cauterized, but not the sclerosed surfaces. The nitrate-of-silver stick is the best application; acid nitrate of mercury and the stronger caustics often aggravate instead of relieving the condition. Cauterization should not be repeated too frequently—once a week is often enough. In the gummatous form of glossitis, cauterization is only demanded to hasten the process of repair when this has once set in. A light application of tincture of iodine about the border of the ulcer, once or twice a day, or a slight pencilling with the crayon of nitrate of silver to stimulate forming granulations, is all that is required.[1]

PHARYNX.—Lesions of the pharynx, though not among the commoner lesions of the mucous membranes, are not rare. Mucous patches, as has been observed, are not found in this locality, but ulcerating submucous tubercles, gummata, and bone lesions, are not infrequently met with. The ordinary or serpiginous ulcers of the pharynx are commonly met with in the posterior wall, and resemble the same lesions as observed in the hard palate.[2] Gummata of the pharynx are among the late lesions, and are usually situated on the posterior wall, the lesion showing itself first in the form of a small subcutaneous nodule, which increases in size very gradually, pushing forward the mucous membrane under which it lies, and which becomes discolored. After a greater or less period of time has elapsed, the tumor softens and ulcerates, or, if proper treatment has been employed in time, resolution may take place without a scar. Gummata of the pharynx may be mistaken for cancer.

Maisonneuve[3] gives the case of a patient who underwent a serious operation for a supposed encephaloid cancer of the pharynx. After six months the tumor began to grow again, and grew so rapidly that the patient was given up in despair and sent to the hospital to die. When examined, upon his entrance, an enormous tumor was found occupying the left lateral region of the neck and the entire parotid region. It projected into the pharynx, obliterated the velum palati, and threatened the patient with death by asphyxia. The true nature of the tumor being suspected, the patient was at once placed upon iodide of potassium in sixteen-grain doses thrice daily. In *less than six weeks* the tumor had disappeared without leaving a vestige !

Carcinoma, in fact, is the affection with which gumma of the pharynx is most apt to be confounded. It should be remembered, in making the diagnosis, that the cancerous tumor (it is epithelioma which is here understood) is not as sharply circumscribed as the gumma, that it is less movable in the surrounding tissues, and, contrary to what is observed in gumma, is usually accompanied by some change in the neighboring lymphatic ganglia. Retropharyngeal abscess is distinguished from gumma, when acute, by the inflammatory concomitant symptoms, and when subacute and cold, by the very early appearance of fluctuation.

The *prognosis* of syphilitic affections of the pharynx is grave when any important function is involved, when a large gumma in suppurating gives rise to purulent infection, or when irregular contractile cicatrices are formed,

[1] For further information see various monographs by Bouisson, Gaz. Méd. de Paris, 1846; Lagneau, Des Tumeurs Syphilitiques de la Langue, Gaz. Hebdom., 1859, Nos. 32, 33 et 35, and Arch. Gén de Méd., t. i., 1860, p. 217; and Maisonneuve, Sur les Tumeurs de la Langue. Thèse de Concours. Paris, 1848.

[2] See Wigglesworth, Buccal Ulcerations of Constitutional Origin. A paper read before the American Dermatological Association, at the fifth annual meeting, Newport, 1881. Archives of Dermatology, January, 1882.

[3] Leçons Cliniques sur les Maladies Cancereuses. Paris, 1854.

which may, in some cases, interfere with phonation or audition. Late affections of the pharynx are very apt to be present, or to have existed, in cases of cerebral syphilis.

The *treatment* of syphilis of the pharynx is, in the first place, that of the constitutional affection; then, the local applications described under the heading of lesions of the mouth, and, in addition to these, the use of medicated vapors by means of the atomizer, as described by Wigglesworth. Bumstead and Taylor employ saturated solutions of nitrate of silver, applying the vapor by an arrangement of glass tubes which permit the spray to be directed to the very seat of the disease.

ŒSOPHAGUS.—The occurrence of stricture of the œsophagus as a result of syphilis was, according to Bumstead and Taylor, first pointed out by James F. West, of Birmingham,[1] who reported a case where, without direct evidence of syphilitic disease of the œsophagus, the collateral evidence of such disease, as giving rise to fatal stricture, was very strong. Other cases have since been reported, among them a very interesting one by the late Dr. F. F. Maury, of Philadelphia,[2] where gastrostomy was performed. As yet, however, direct evidence of syphilitic lesions in the œsophagus leading to stricture has not been presented, though gummata have been found in the walls of the tube. The treatment in suspected cases would, of course, be the usual anti-syphilitic treatment, strongly pushed in the earlier stages. In the cicatricial stage, dilatation with bougies is a palliative measure; or the establishment of an œsophageal or gastric fistula might be resorted to in extremity.

STOMACH AND INTESTINES.—Functional disturbance of the digestive organs, shown by loss of appetite or by inordinate desire for food, as well as by occasional vomiting, is not uncommon, especially during the earlier stages of syphilis. Whether the same organic changes may occur in these viscera as are observed in the external parts during the earlier stages of syphilis, is a question as yet undecided. Late lesions, as gummatous infiltration followed by ulceration of the stomach and intestines, may however occur, and cases of this kind have been reported where post-mortem examination proved the existence of quite extensive disease. The symptoms during life were those of dyspepsia or chronic diarrhœa, but little more.[3] In many reported cases, iodide of potassium was employed in large doses by the stomach, or, where this was irritable, in the form of enemata (gr. xv–lxxv to water, ℥iv–vj).

RECTUM AND ANUS.—Many cases of so-called syphilitic stricture of the rectum are, in reality, nothing more than the contraction due to chancroidal ulcers.[4] In these, of course, specific anti-syphilitic treatment is without avail. The early syphilitic lesions may also, according to Barduzzi, produce stricture of the rectum.[5] But it is in the later stages of the disease that this condition is most likely to be produced.

Syphilitic stricture of the rectum is much commoner among women than among men. Statistics collated by Jullien show that of 60 cases, 7 were in men and 53 in women. What the reason of this diversity may be, it is impossible to say. Many women date the beginning of their trouble to a previous pregnancy. The affection is commonest in middle life.

[1] Dublin Quarterly Journal of Medical Science, February, 1860.
[2] Am. Jour. Med. Sci., April, 1870.
[3] See Cornil, op. cit., p. 406; Cullerier, De l'Entérite Syphilitique, Union Méd., 1854, t. iv.; Lancereaux, op. cit., p. 248.
[4] The occurrence of chancre of the rectum is more than doubtful.
[5] Giorn. Ital. d. Mal. Ven., No. 1, 1875.

The manner in which stricture of the rectum is produced is, in all cases, by the contraction of a cicatrix following an ulcerative lesion or a submucous gumma. The ulcerative lesion is a comparatively early syphilitic development, and often coincides with cutaneous and mucous manifestations. The ulcers, as seen near the anus, are usually elongated in the direction of the swollen anal folds, between which they are often hidden, so as not to become visible until the mucous membrane is put upon the stretch. Further up in the rectum they are roundish, sharply cut, and almost always covered with pultaceous detritus and adherent mucus. To the touch they offer the sensation of a granular, somewhat resistant substance. Their duration is naturally long, and they are subject to phagedæna, owing to the various causes of irritation to which they are exposed. When the syphilitic ulcer of the rectum does heal, cicatrization is apt to cause a valvular stricture, if it has involved a portion, or an annular stricture, if it has extended around a greater part of the circumference of the tube.

Submucous gummata of the ano-rectal region are extremely rare, but their existence is maintained by Jullien.

Diffuse gumma, called by Fournier "ano-syphiloma," is a late lesion, and consists in an infiltration of the ano-rectal walls by a neoplasm of, as yet, undetermined structure, originally, but susceptible of degenerating into a retractile fibrous tissue, and thus giving rise to narrowing of the intestinal calibre to a greater or less degree and extent. It is the most frequent cause of rectal stricture.

Ano-rectal syphiloma is more frequently met with about the rectum than about the anus. In the former position, its chief symptom is a hard, firm thickening of the rectal walls. To the touch, the walls of the rectum are not only hard, but they are rough, mammillated, and divided into thick ridges. The mucous membrane is, both to touch and to ocular examination, perfectly healthy.

It is the lowest portion of the rectum which is the customary seat of the form of syphilis under consideration; it rarely extends to more than two and a half inches beyond the anus. The lesion is indolent in its earlier stages, giving neither pain nor inconvenience.

The anus is rarely affected alone by this lesion, but almost always in connection with the rectum. The lesion here takes a nodular or sometimes a vegetative form.

Treated in good time, the ano-rectal syphiloma, and also the other syphilitic anal and rectal manifestations, may be dissipated and caused to disappear. Neglected, as these affections too often are, they not only persist, but they tend to degenerate, and thus lead inevitably to stricture of the rectum.

Treatment.—To be successful, the treatment of syphilitic disease of the rectum and anus must be undertaken early in the history of the affection. If postponed until cicatrization sets in, anti-syphilitic treatment has but little effect. When cicatrization has begun, it proceeds usually without regard to any treatment which can ordinarily be administered.

The usual anti-syphilitic treatment is, of course, called for, and should be pushed vigorously as long as any chance of success by this means can be hoped for. When constriction of the rectal tube has once fairly begun, internal medication, as has just been said, is of no avail. Dilatation by means of bougies may serve to keep the passages open for an indefinite period, and should be practised assiduously. When this fails, and complete stenosis of the rectum is threatened, operative interference is called for, as will be set forth in other portions of the work.[1]

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[1] Fournier, in his complete monograph, Lésions Tertiaires de l'Anus et du Rectum, Paris, 1875, says that he has known half a dozen patients suffering with syphilitic stricture of the rectum, who, by using dilatation with bougies from time to time, have been able to go about comfortably for five, eight, and ten years.

SYPHILIS OF THE OLFACTORY AND AUDITORY APPARATUS.

OLFACTORY APPARATUS.—The mucous membrane, cartilages, bones, and nerves connected with olfaction, may be affected by syphilis in one stage or another of its evolution. The pituitary membrane may, in the earlier stages of the disease, be the seat of erythema, mucous patches, or superficial ulceration, just as the buccal mucous membrane is the seat of such lesions. Sometimes an erosion or shallow ulcer may be seen within the nasal orifice, surrounded by swollen mucous membrane, and rendering the ala nasi tender upon pressure. Plugs of inspissated mucus, mixed with blood and pus, frequently obstruct the passages, and are from time to time discharged. The character of these lesions is often difficult to make out in the absence of other concomitant syphilitic manifestations, and sometimes only their disappearance under anti-syphilitic remedies serves to show their true nature.

Rhinitis.—In the later stages of syphilis, ulcerative syphilitic rhinitis, or syphilitic ozæna, is met with, one of the gravest of the ulcerative affections of the mucous membranes, and one which is all the more dangerous because so often mistaken for simpler and milder affections, until it has made irreparable ravages.

At the outset, stuffing up of the nostril, with sensitiveness over the affected point, and some catarrh, is observed. From time to time dark spongy crusts covered with blood are expelled, together with an almost odorless, serous fluid, and also mucus. When it has extended more deeply, the affection gives rise to an ill-smelling, sero-sanious discharge, which becomes more fetid as the disease penetrates more deeply. If the affection happens to be seated near the opening of the nares, a roundish, elevated, fungous ulcer, usually covered with a yellow crust, can be seen on the nasal septum or within the ala. The rhinoscope is necessary to examine lesions further within the nasal passages.

Whether the lesion begins in the mucous membrane and penetrates to the bone, or whether the osseous lesion is first in point of time, and the superjacent mucous membrane only becomes involved at a later period, fragments of cartilage and bone are very apt to be denuded, detached, and discharged. In this case the discharge becomes blackish and extremely fetid, the sense of smell is almost or entirely lost, the mucous membrane in the neighborhood of the ulcers becomes swollen and painful, and the nose changes its shape, and, if the septum is attacked, becomes flattened.

The ulcerative process may perforate the floor of the nasal cavity, extend into the pharynx, find its way along the Eustachian tube, and even penetrate the cranial cavity, involving the meninges; more commonly, however, the membrana tympani becomes ruptured, and purulent discharge takes place through the external auditory canal. Deafness may ensue from obliteration of the Eustachian tube by a cicatrix. The disease has been known to pass up the lachrymal canal, involving the lachrymal bone and even the eye (Bumstead and Taylor). Respiration through the nose is usually hindered more or less by the lesions described, and sometimes it is permanently prevented, breathing being entirely performed through the mouth, and the voice having a nasal twang.

Treatment.—The constitutional treatment of syphilis of the nasal passages is that of the disease in general, and its nature must depend upon the stage of the affection and upon the character of the lesions. In addition to mercury and iodide of potassium, tonics and cod-liver oil are frequently called for. The most efficacious local treatment is by means of mercurial inhalations, a sufficient quantity of calomel or of the bisulphuret or binoxide of mercury being heated on a metallic plate over a spirit lamp, and the fumes being directed

into the nostrils by a cone of paper or other convenient method. Blood-warm injections of a strong solution of chlorate of potassium or of common salt (℥j ad Oj), or of a diluted solution of chlorinated soda (1 part to from 12 to 20 parts of water), are also useful. The nostrils should first be thoroughly cleansed by means of the nasal douche. It is a matter of great importance to follow out a thorough and complete system of cleansing and local medication in these cases, in order to limit and check the progress of the disease as rapidly as possible, and it must be remembered that, as long as there is any necrosed bone to come away there will be a foul discharge, so that the prognosis must be made with this fact in view.

Olfactory Neuritis.—That the olfactory nerves may be attacked by syphilis has been shown by Bayle and Kergaradec[1] who cite a case where these nerves were destroyed. Virchow also gives a case where these nerves were lost, so to speak, in the general disorganization of surrounding tissues. Gros and Lancereaux[2] likewise cite analogous cases. Anosmia is of course the prominent symptom under these circumstances.

Auditory Apparatus.—Syphilis of the ear is comparatively rare. Buck, of New York, met with but 30 cases out of a total of 3976 cases of ear affections, though, owing to the fact that many cases go unrecognized, the proportion is probably larger. Chancre of the external ear has been met with in one recorded instance, and the various syphilitic lesions of the skin are of course encountered here, papules being most apt to occur in the post-auricular angle and upon the lobule of the ear, while the macular syphiloderm is seen in the fossa navicularis and concha. Vegetating papules are found in the external auditory canal, solitary or few in number near the outer opening, but sufficiently numerous and luxuriant further inwards to occasionally fill up the canal and hide the drum. Sometimes vegetations form on the drum itself, when perforation may result. They are accompanied by the discharge of a sero-purulent fluid which causes the affection to look like otitis externa. Simple papules or papulo-squamous lesions are not found within the meatus.

At a later period in the evolution of syphilis, ulcers of roundish form, covered with diphtheritic membrane, are liable to occur within the meatus, and gummata of the cellular tissue, cartilage, or bone, are also met with. Hyperostosis and exostosis may likewise occur in the external bony canal.

The middle ear is that portion of the olfactory apparatus which is most apt to be the seat of syphilitic disease. Chancre of the Eustachian tube has been reported as the result of using unclean aural instruments, and mucous patches are not infrequently met with either in this tube or in the middle ear, sometimes disappearing under treatment, but sometimes ulcerating and destroying the tissues to a greater or less extent.[3]

Syphilis of the Eyelids and Lachrymal Apparatus.[4]

The various tissues which go to make up the eyelids may each be the seat of one or another of the lesions of syphilis. Chancres of the eyelids have

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[1] Nouv. Bibliothèque Méd., quoted by Lancereaux.

[2] Affections Nerveuses Syphilitiques.

[3] For a description of the syphilitic lesions of the middle and inner ear, reference may be made to the article on affections of the ear in Vol. IV. of the present work ; to Bumstead and Taylor's Treatise (p. 730 et seq.); and to the following monographs and papers : Gruber, Ueber Syphilis des Gehörorgans (Wien. med. Presse, 1870, 1, 3, 6, 10); Roosa, Syphilitic Affections of the Ear (Am. Jour. Syph. and Derm., 1871, p. 97); Sexton, The Sudden Deafness of Syphilis (Am. Jour. Med. Sci., July, 1879, and Jan. 1880); and F. R. Sturgis, Affections of the Middle Ear during the Early Stages of Syphilis (Boston Med. and Surg. Jour., vol. cii. p. 533, 1880).

[4] The syphilitic lesions of the eye proper are considered in another article.

been reported ; the syphilodermata may affect the skin of the lids ; mucous papules or mucous patches may occur upon their commissure ; the glands may be involved, causing blepharitis; and gummata of the angle of the eye are not very rare. Most of these lesions are easily distinguished from the non-syphilitic affections which they resemble. A form of late ulceration occurring near the free border of the lids is liable to be mistaken for *ophthalmia tarsi* or *epithelial cancer*, but the history, and in a last resort the touchstone of treatment, will settle the question. Bumstead says that non-ulcerating gummatous nodules from small-pea to filbert size occur in the lids, the skin over them being unchanged in color or appearance. These may sometimes remain unaltered for a considerable period, and are liable to be mistaken for *tarsal* or *meibomian tumors*. They may usually be resolved by the free use of antisyphilitic remedies, especially the mercurials.

Syphilitic inflammation of the *tarsal cartilages* is characterized by a thickening from inflammatory infiltration of the cartilage, which usually retains its shape, and from swelling of the lid, in which the skin may or may not be involved. The cartilage is apt to lose its normal elasticity. The affection is obstinate, lasting weeks or months, and is apt to be followed by loss of the cilia.

The affections of the *lachrymal ducts* have been carefully studied by various writers, among others by Lagneau,[1] who says that they are generally due to some osseous lesion—periostosis, exostosis, caries, or necrosis ; more rarely they are due to some lesion of the soft parts. The chief diagnostic marks are the presence of an indurated, resistant swelling, of a bony character at bottom, perceived by the touch at the lower and internal portion of the orbit, or by the sound in the nasal duct. The syphilitic character of the cutaneous orifice of the fistula, when one exists; the coincidence of late syphilitic lesions in the neighborhood, or elsewhere; and the history of the case, will also throw light on the nature of the disease. The course of the affection is slow, with occasional erysipelatoid attacks. Internal treatment, employed at an early stage, must be relied upon.

Syphilis of the Generative Apparatus.

Penis and Urethra.—The *urethra*, both in the male and in the female, may be the seat of various syphilitic lesions analogous in most respects to those occurring in the respiratory and alimentary passages. The cavernous structure of the *penis* may be the seat of a gummatous deposit which may give rise to a sort of chordee ; the affected section of the penis being flaccid during erection, the organ assumes a curved shape, and is pointed in one direction or another according to the seat of the gumma. Other deposits in the cavernous portion of the penis may give rise to the same symptom, which is not, therefore, peculiarly characteristic of syphilis.

Bumstead and Taylor[2] speak of a tubercular or gummy ulcer of the penis which closely resembles chancroid, with sharply-cut edges and grayish excavated floor, an abundant purulent secretion, and a soft base, seen most frequently in the furrow at the base of the glans, where it tends to undermine the integument of the penis.[3] This sore, however, is solitary, while chancroid is usually multiple.

Testicle.—*Syphilitic Epididymitis.*—First described by Dron[4] in 1863,

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[1] Maladies Syphilitiques des Voies Lachrymales. Arch. Gén. de. Méd., 1847.
[2] Op. cit., p. 361.   [3] See Pl. XIII. Fig. 3.
[4] De l'Épididymite Syphilitique. Arch. Gén. de Méd., 1863.

this affection is characterized by the insidious occurrence of a small, smooth, round or oval tumor just above the testicle, the latter and the scrotum itself being unaffected. Its size varies from that of a pea to that of a Lima bean. It is indolent, and may exist for a long time unchanged. It readily disappears under the influence of mercury. This affection is a rather early manifestation of syphilis, occurring in most cases within the first six months. It may, however, show itself as early as the second month, or as late even as the fifth year after infection. It may be confounded with *tubercular epididymitis*, and has sometimes been mistaken for the result of *acute* or *chronic urethral inflammation*. An important point in the diagnosis of the affection is that it attacks the globus major, whereas in *gonorrhœal epididymitis* the globus minor is most commonly involved alone.

Syphilitic orchitis may occur as soon as the fourth or fifth month after contagion, while early symptoms are still present; but in the majority of cases it does not appear until several years after the primary sore, and is accompanied by well-marked late manifestations in the fauces, periosteum, or bones; or in some instances it is the only evidence of syphilitic disease which the patient presents.

Syphilitic orchitis commonly attacks both testicles, either at the same time or one after the other. The testicle becomes enlarged, without pain, even on pressure, or any sign of inflammation. There is a feeling of weight, especially towards evening, as the testicle grows heavier, and sometimes a dull pain is felt about the loins; but there is no nocturnal exacerbation, as is usual with many syphilitic troubles. The testicle is somewhat increased in volume, but rarely above double its normal size. Some of the apparent swelling is due to hydrocele, as there is in nearly all cases a slight effusion into the tunica vaginalis. When considerable effusion is present, it may be necessary to evacuate the fluid before the condition of the testicle can be ascertained, but commonly a little manipulation will enable the gland to be grasped and examined. At an early stage in the disease, small indurated nodules, of a gummatous character, can sometimes be felt upon the surface of the testicle, and at a later period these may coalesce and form an indurated tumor, but without giving rise to great irregularity of outline. Sometimes the tumor is smooth from beginning to end. The course of the affection is slow, frequently lasting for several years. Left to itself, it frequently terminates in obliteration of the seminiferous tubules and partial or complete atrophy; at other times the parenchyma of the gland may degenerate into fibrous, cartilaginous, or even osseous tissue. It was formerly supposed that suppuration never took place in uncomplicated syphilitic orchitis, but it has been shown that this result is occasionally observed.[1]

There are two forms of syphilitic orchitis, pathologically considered. In the first or diffuse form, a sub-inflammatory condition is found, with diffuse cell-infiltration and effusion. In the circumscribed variety, there are gummatous nodules scattered through the body of the testicle. The two varieties may occur together.

Syphilitic orchitis may be confounded with gonorrhœal epididymitis, with cancer, with tubercular disease of the testis, or with simple chronic orchitis. The *gonorrhœal* affection is so clearly inflammatory in its character—being attended by severe pain, difficulty of motion, redness, heat, and tension of the scrotum—that these symptoms alone should suffice to distinguish between the two conditions. In *cancer* of the testicle (generally encephaloid), the pain, slight at first, increases with the progress of the disease, and becomes very severe and

[1] Secondary softening of the interior sometimes takes place. See Lancereaux, op. cit., 2me éd., p. 221, and for an illustration, Ibid., Pl. I. Fig. 9.

lancinating; the tumor is irregular in shape, grows with great rapidity, and often attains an immense size; and the cord and neighboring ganglia are frequently involved. *Tubercular* disease of the testis comes on about puberty in strumous subjects; the deposit occurs in the epididymis or in the centre of the testis; adhesions with the scrotum and tunica vaginalis occur, and suppuration and ulceration may follow. Evidences of tubercular deposit may often be detected simultaneously in the vesiculæ seminales, by examination with the finger *per anum*, or in the cord or inguinal ganglia. *Chronic orchitis* is a very rare affection, and the diagnosis between it and the disease under consideration can usually be made by exclusion.[1] In cases of doubtful diagnosis, it is always best to wait, and, if necessary, attempt a cure by specific medication before operating. It is said, on good authority, that many patients suffering from curable syphilitic orchitis have been uselessly castrated by rash operators.

Iodide of potassium combined with mercury is the best remedy in syphilitic orchitis, which will often yield to the "mixed treatment" when the iodide alone, even in large doses, has failed. With broken-down patients, mercurial inunctions, with iodide of potassium and tonics internally, form the best treatment. The testicle may be supported by a suspensory, and, in case the effusion into the tunica vaginalis is excessive, it may be evacuated by means of a lancet or broad needle. The danger of wounding the swollen testis is too great to admit the use of a trocar, as employed in the ordinary method of tapping for hydrocele.[2]

Syphilis of the Female Generative Organs.—In addition to the early manifestations of syphilis—chancre, moist papules, mucous patches, etc.—which have been already described as they are found upon the external genitalia of the female and upon the cervix uteri, other later lesions, chiefly tubercular and ulcerative-tubercular in character, are found in these parts. They do not, however, present any peculiarities worthy of special note.

Syphilis of the *uterus* and its annexes, however, requires some special mention. With regard to the uterus itself, some doubt exists as to whether syphilis in its later forms has been known to attack this organ. It seems likely, however, that certain cases of so-called cancer of the uterus are nothing more than ulcerated tubercular or gummatous deposits, since, in one or two instances,[3] specific treatment has brought about a cure when cancer had been diagnosticated and a fatal result looked for.

Lecorché and Lancereaux[4] have reported cases where the *ovaries*, in undoubtedly syphilitic cases, appeared at the autopsy to have been the seat of diffuse or sclerous syphiloma. These cases showed no clinical sign of the disease found. Gummatous tumors of the ovaries, as in a case reported by Lancereaux, have shown their existence by objective symptoms during life, in the shape of egg-sized enlargements, elongated in the direction of the broad ligament, quite perceptible in the ovarian region, and disappearing under the use of iodide of potassium. Richet also reports a case where autopsy revealed an undoubted gummatous tumor in the substance of an ovary.

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[1] Bumstead and Taylor (op. cit., p. 637) give the more prominent symptoms of chronic orchitis. Curling (On the Testis, 2d ed., London) may also be referred to in this connection.
[2] Bumstead and Taylor.　　　　　　　　　　[3] Cited by Jullien, op. cit., p. 934.
[4] Jullien, op. cit., p. 935.

Syphilis of the Kidney.

The earlier disturbances of the urinary function have been already mentioned (page 482). The affections of the kidney about to be described are of later date, and of more serious significance.

Syphilis of the kidneys is of two varieties, pathologically dissimilar, but clinically not to be differentiated. One is characterized by gummatous deposits; the other is a diffuse nephritis, not unlike the diffuse syphilitic sclerosis of the lungs and testicles.

In both forms of syphilitic kidney-trouble, the affection begins in an insidious manner. After a time the effect of the renal disease comes to show itself in the system at large; the patient becomes pale and weak, suffers from general malaise, with gastric disturbance, nausea and vomiting, headache, lumbar pain—in a word, the usual symptoms of beginning renal disease. At a later period, œdema about the ankles, puffiness of the face, and extravasations into the serous cavities follow, as do also epistaxis and hæmoptysis. At this stage the polyuria and albuminuria become somewhat lessened; the patient is like the subjects of ordinary Bright's disease, and, unless the morbid process can be arrested, goes on through anasarca, ascites, "indolent" pleurisy, lesions of the eye and brain, and finally complete cachexia, to death.

It will be observed that the symptoms just mentioned are manifested by syphilitic kidney affections in common with non-syphilitic renal troubles, but as regards prognosis the difference is very marked. Taken in time, and appropriately treated by means of mercury and iodide of potassium, together or alone, the morbid process is arrested, amelioration can be hoped for in many cases, and it is not rare even to obtain a complete cure.[1]

Of course, it is understood that timely measures are carried out; the treatment should be prompt, thorough, and persistent, from the moment when the nature of the affection is understood.

Syphilis of the Liver.

EARLY HEPATIC SYPHILIS.—The earliest manifestations of syphilis in the liver have already been described (page 481), but those which occur at a later period in the history of the disease are of more importance and deserve a fuller discussion. In what may be called the middle stage of the early evolution of syphilis, the liver is now and then attacked in the same manner as in the earlier period already described, but to a rather more marked degree. This form is met with from two and a half to three months after the first outbreak of generalized symptoms, and is accompanied by hypertrophy of the liver, pain, and sometimes icterus, together with certain concomitant symptoms to be mentioned. The liver begins to enlarge at an early period, and continues to increase in volume until treatment is instituted. It remains stationary for a time under treatment, and then begins slowly to decrease in size, but with interruptions caused by recurrent attacks of congestion, alternations of amelioration and aggravation occurring without ostensible cause. The volume of the liver is variable, but in some cases the organ may rise as much as two fingers' breadth above the floating ribs in the line of the nipple, and may form a more or less prominent tumor in the line of the sternum.

Pain is a constant symptom. Weight in the hypochondrium, difficulty of locomotion which aggravates the pain, and increased distress with lancinat-

[1] See Fournier (op. cit.), for a striking case illustrating the curability of this affection.

ing pain on percussion or palpation, are characteristic symptoms. The pain leaves before the hypertrophy has been entirely reduced by treatment.

Icterus is not a constant symptom. When present, it comes on after the hypertrophy and pain, and disappears with those manifestations. When observed, it is intense, with scanty, bile-colored urine, and clayey stools; but none of these symptoms persists more than a few days after treatment has been instituted.

As was observed above, in treating of the earliest forms of syphilitic liver trouble, gastric and intestinal catarrh are absent. The digestive disturbances noted supervene *after* the appearance of the hepatic disorder, and are accounted for by the condition of the liver. Loss of appetite is observed, while the tongue is moist and normal in appearance. Digestion is slow and difficult, and accompanied by sensations of weight and discomfort in the epigastric region, and by a tendency to constipation. The other symptoms of syphilis, eruptions of various kinds, cephalalgia, etc., usually relapse or break out afresh coincidently with the appearance of the hepatic disorder, and it has been observed that in some cases the spleen and kidneys are involved at the same time.

The *diagnosis* of this form of syphilis of the liver, which it may be mentioned is a rather rare affection—if we may judge from the scanty records published—must be made chiefly by exclusion. There is scarcely any affection excepting syphilis which can give rise to this sub-chronic condition of the liver, and of course the coincidence of other syphilitic manifestations is an important aid.

The *prognosis* is more serious than in the earlier form of hepatic trouble, and it is likely that the repeated congestive attacks and relapses which mark the course of the affection, point to a *locus minoris resistentiæ* which may be the seat of subsequent attacks of syphilitic disease of a more serious character. The coincidence of other visceral manifestations, and the fact that when eruptions of the skin occur in this connection they are often of the type called "precocious" and "malignant," also mark the affection under consideration as one of serious import.

The *treatment* should be prompt and energetic, every effort being made to build up the patient at the same time that specific remedies are administered with a free hand. The "mixed treatment" is that to which recourse should be had, and in order to save the stomach as much as possible, mercurial inunction may be combined with the internal administration of iodide of potassium, beginning with the dose of five grains thrice daily, given immediately after eating, and rapidly increasing this to ten grains or more at a dose, care being taken to avoid irritation of the stomach. (See remarks on treatment.) Tonics, such as iron and quinine, nourishing food, douche and other baths, and change of air and scene, may be required in one case or another. It must be remembered that it is not merely a patient with liver trouble that must be treated, but at the same time an individual poisoned by an unusually severe attack of syphilis, which may even threaten life in its later stages, if these, its earlier manifestations, are not deprived of their virulence and crushed out.

Among local remedies various revulsives may be used. Dry cupping, and afterwards, flying blisters, are perhaps the most satisfactory in their effects. It must not be forgotten that even after the patient appears to be cured, relapses may take place, and that the antisyphilitic treatment should be kept up for a long time, or, if this is impossible, should be resorted to for short periods at intervals.

LATE HEPATIC SYPHILIS.—The late syphilitic lesions of the liver manifest themselves under two forms—1. Interstitial hepatitis. 2. Gummatous hepa-

titis. Lacombe[1] considers these two forms as anatomically the same, but they are best described separately. Some authors consider amyloid degeneration of the liver as a syphilitic lesion, but it is rather the effect of a cachexia which may or may not be syphilitic in origin. Again, perihepatitis has been considered as an independent affection, but recent writers regard this as merely the result of interstitial hepatitis.

In perihepatitis, the lesions are situated in the fibrous envelope of the organ, which is thickened, and which shows marked adhesions attaching it to the neighboring organs, particularly the diaphragm. The membrane sometimes contains a greater or less number of small, hard, whitish nodules.

In interstitial hepatitis, the volume of the organ varies according to the stage of the disease. In the earlier stage it is hypertrophied, in the later stage atrophied and shrunken. The color of the organ is changed to a more or less bright yellow on the surface, and in section, when also white striæ formed by the prolongations of the hypertrophied fibrous membrane can be seen.

In the gummatous form of hepatitis, a more or less considerable number of gummy tumors, similar to those observed in the cellular tissue, are found in various stages of evolution. Virchow has described a syphilitic lesion of the liver which assumes the form of cicatrices. The surface of the liver is also found to show loss of substance at circumscribed points, replaced by whitish stellate patches, the prolongations of which penetrate more or less deeply into the tissues beneath. The biliary canals and vessels are rarely intact; sometimes they are found to have entirely disappeared. The lesions may occupy the entire organ or only a single lobe.

Syphilitic affections of the liver are most apt to occur in individuals who have not been properly treated during the early stages of their disease, either because of neglect, or because the earlier manifestations were so trifling as to escape notice. It is commonly met with between the ages of thirty and forty. Extraneous influences, such as traumatism or superactivity of the organ, predispose to the disease. Alcoholism is a recognized predisposing cause.

Symptoms.—The symptomatology of syphilis of the liver is by no means as well understood as its pathology. The course of the disease may be divided into three stages, corresponding to the pathological changes which take place in the affected organ.

(1) The *first stage*, corresponding to that of connective tissue hyperplasia—hypertrophy of the liver—is characterized by enlargement of the organ to a degree perceptible to external examination. Percussion shows dulness, sometimes extending two or three finger-breadths above the floating ribs, while the tumor can be seen in the epigastric region. This hypertrophy is a late manifestation; it may occur from three to four years after the early syphilitic symptoms, or in some cases as late as twenty years. Its duration is very variable. It may increase by successive exacerbations.

Pain is a characteristic symptom. Usually of a dull dragging character, and aggravated on walking, it may occasionally occur in acute paroxysms of much greater severity, especially at night. The pain radiates toward the epigastrium, the iliac fossa, and the kidneys. It gives rise to such sensitiveness that the least pressure causes distress, and that patients cannot at times even so much as button the clothing.

Icterus, usually succeeding the hypertrophy, is an occasional symptom of this period of hepatic syphilis. It is supposed to be due, under ordinary circumstances, to extension of the inflammation to the bile-ducts, and to obliteration of these by desquamation. Another explanation, suggested by the

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[1] Étude sur les Accidents Hépatiques de la Syph. chez l'Adulte. Thèse de Paris, 1874.

observations of Virchow and others, is stoppage of the biliary passages by pressure from a gumma. Clinically, the icterus in the first of these cases is more marked, but not as persistent, as in the second case—that of compression by a gumma.

Ascites is occasionally observed, though not to a marked degree. It is due to involvement of the hepatic vessels interfering with the circulation in the liver.

The chief characteristic of these various symptoms of the first period of hepatic syphilis is that of being curable. They yield with tolerable promptitude to antisyphilitic treatment.

In addition, the spleen and kidneys may be involved simultaneously, ulceration of the pharynx is very apt to be present, and various other symptoms of syphilis may coexist to make the diagnosis easy. It should be remarked that digestive troubles are not usually present.

(2) The *second stage* is unmarked by any physical or functional symptoms of a characteristic nature.

(3) The *third stage* is marked by physical and functional symptoms. Atrophy is generally well marked, but as atrophy of one part of the liver is at times compensated by hypertrophy of another, percussion must be made very carefully, when it will show marked irregularity of outline—atrophy in one place, hypertrophy in another. Occasionally, irregularities and lobulations can be perceived by manipulation of the edge of the liver. Sometimes the abdominal walls will be observed to be immobile during respiration, instead of gliding over the surface of the liver, as in the normal condition.

Among the functional signs, *icterus*, although sometimes observed, is rare. *Ascites* is well marked, beginning slowly and insidiously, through the period of a month or more, and then suddenly developing to a considerable degree within four or five days, so as to interfere with locomotion and to hinder respiration, requiring puncture at times, and even then oftentimes returning with increased rapidity. Ascites is a grave symptom when it appears; little or no relief can be expected from treatment.

Digestive disturbances constitute a marked feature of the affection under consideration. They arise in part from the condition of the liver, and in part from the general cachexia. Vomiting is an early symptom; it may precede all others. Diarrhœa, on the other hand, is more frequent in the later stages of the disease, when it is met with in six cases out of seven. The stools are pale and discolored if there is retention of bile. The intestinal functions are likewise imperfectly performed; there is meteorism; the abdomen is distended ; and, as nutrition does not go on perfectly, the patient becomes thinner day by day.

The course of hepatic syphilis is slow, progressive, insidious, or even concealed. In some cases it runs its course without giving rise to any perceptible external symptoms. Its duration is long, unless when an extension of the ascites or some complication causes death, and it may exist months or years without causing any considerable disturbance of the system at large. The affection terminates most frequently by producing marasmus and cachexia.

Diagnosis of Hepatic Syphilis.—Syphilis of the liver is to be distinguished from *cancer*, *hydatid cyst*, and *drunkard's liver*. The diagnosis is at times very difficult, but attention to the following points may aid in distinguishing doubtful cases :—

Cancer only shows itself at an advanced age, fifty or sixty years on an average. It invades both lobes at the same time. Pain is more severe ; there is vomiting, rapid depression of the vital forces, and special cachexia. The affection does not last more than from six months to two years. Icterus is

very marked, or at least the characteristic discoloration of the cancerous cachexia.

Hydatid Cyst.—A fluctuating, globe-like projection, larger than that of the syphilitic disease, advancing toward the epigastrium, and often simulating a lesion of the stomach. Pathognomonic vibratory trembling. Digestive troubles. Dyspnœa. Ascites rare.

Drunkard's liver is distinguished anatomically from syphilis of the liver by its localization at the periphery of the lobule. The neoplasm incloses the lobule, but does not penetrate it—does not interpose between the cellules. Clinically, the lesions are more extensive than those of syphilis; ascites is more frequent. The course of the disease is slow. There are various digestive symptoms coincident: dyspepsia and anorexia; also nervous disturbances, as formication, cramps, and trembling.

The *prognosis* of hepatic syphilis is grave. If the affection can be taken in time it may be cured in many cases, but if atrophy has set in, the prognosis is very serious.

Treatment.—The "mixed treatment" offers the best chance for a cure. It is better than the use of either mercury or iodine alone.

The literature of hepatic syphilis, particularly that which relates to the pathological anatomy of the disease, is very abundant, much attention having been paid to the subject in the last few years.[1]

Syphilis of the Racemose Glands.

MAMMARY GLANDS.—The mammary glands are rarely attacked by syphilis, but twenty cases, according to Jullien, are on record. The affection is of two kinds, diffuse sclerous infiltration, and localized gummy deposit.

The first variety is apt to be met with among men. It is a comparatively early manifestation, and is characterized by diffuse tumefaction, by tenderness on pressure, without external inflammatory appearance, and by rapid disappearance under specific treatment.

The gummatous affection of the mammary glands is a late syphilitic manifestation, and is much commoner among women. When first noticed, the gumma is often buried deeply in the tissue of the mammary gland, and may easily be mistaken for an *adenoid* tumor. It grows in size, however; sometimes attaining that of an egg or an apple, or even (in one case reported by Sauvage) that of a child's head. The tumor is irregular and bosselated, and sometimes accompanied by ganglionic engorgement. As it approaches the surface of the skin, fluctuation, or at least the sensation of a softened infiltrated tissue, is perceived, a point of decided diagnostic importance. If not influenced by treatment, the skin softens, and an ulcer is formed.

It is not always easy to distinguish this lesion from *cancer*, and, unless some concomitant and unmistakable syphilitic symptoms are present to guide to a conclusion, the only plan to follow is to use the "touchstone of treatment." But an unnecessary surgical operation may be avoided, perhaps, by giving in doubtful cases the iodide of potassium, or perhaps the "mixed treatment," and watching its effects.

SALIVARY GLANDS.—Lancereaux has reported a case where the *submaxillary* gland, in a patient dying in full tide of syphilis, was found affected by

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[1] The following writers may be particularly referred to, and in their works will be found numerous references to the contributions of others: Lancereaux, Traité de la Syphilis, 2e éd. Paris, 1878; Quinquaud, Affections du Foie, Première Fascicule; Lacombe, Thèse de Paris, 1873; Leudet, Recherches Cliniques sur l'Étiologie, la Curabilité et le Traitement de la Syphilis Hépatique (Arch. Gén. de Méd., Fév. 1866); Cornil, Leçons sur la Syphilis. Paris, 1879.

diffuse syphilitic sclerosis. Fournier has reported a case of syphilitic disease of the *sublingual* gland ; the patient, while suffering from generalized syphilitic symptoms, was attacked by a tumor the size of a date, which could be perceived in the right sublingual fossa, and was firm and hard to the touch. The administration of iodide of potassium reduced the tumor in a few days to its normal volume. Verneuil has reported a somewhat similar case, in which, however, the nature of the tumor was not made out at the time.

PANCREAS.—Lancereaux says that, in many autopsies of syphilitic subjects, the pancreas is found indurated by sclerosis. He also reports a case of gumma of the pancreas, this, with the addition of one reported by Rostan, being the only cases on record.[1]

SYPHILIS OF THE SPLEEN, SUPRA-RENAL CAPSULES, AND THYROID GLAND.

SPLEEN.—The condition of the spleen in the early stages of syphilis has already been alluded to (page 480). Like the lymphatic ganglions, the spleen is almost always attacked by early syphilis, but the later and severer stages of the disease leave it untouched in the vast majority of instances. In the few cases observed after death, gummy deposits were noted in some, but they were usually small and few in number. They were usually situated in the connective tissue of the capsule. Diffuse syphiloma of the spleen is characterized by partial hypertrophy of the organ, the tissues of which are condensed and of a dark-brown color. At a later period, grayish patches are observed, which terminate in depressed cicatrices. Clinically, the affection has rarely, if ever, been recognized.

SUPRA-RENAL CAPSULES.—The supra-renal capsules are often found enlarged in syphilis. Virchow has seen them surrounded by fatty degeneration. Chvostek[2] has reported an interesting autopsy. No clinical facts are known.

THYROID GLAND.—Lancereaux[3] has observed enlargement of the thyroid gland in numerous autopsies of syphilitic subjects. Microscopic examination shows increase of the glandular elements, with occasional fatty degeneration.[4]

SYPHILIS OF THE RESPIRATORY PASSAGES.

LARYNX.—It was formerly thought that all syphilitic diseases of the larynx were propagated from pre-existing lesions in the pharynx, and that they were closely assimilated to these as regarded the period of their develop-

[1] The following references may be made by any one interested in the scanty literature of the subject of syphilis of the racemose glands : Verneuil, Tumeurs gommeuses du Sein (Bull. de la Société Anatomique, 30e année, p. 96); Ambrosoli, D'une Maladie de la Glande Mammaire qui quelquefois s'associe avec différentes formes de la Syphilis (Gazz. Med. di Lombard, No. 36, 1864); Icard, Note sur un Cas de Tumeur Syphilitique simulant un Cancer du Sein (Jour. de Méd. de Lyon, t. vii. p. 21, 1867); Paul Horteloup, Des Tumeurs du Sein chez l'Homme (Thèse d'Aggrégation, p. 42, 1872); Lancereaux, Traité de la Syphilis ; Fournier, Dégénérescence Syphilitique de la Glande Sublinguale (Annales de Dermatol. et de Syphiligr., t. vii. p. 81); Rostan, Altération Syphilitique du Pancreas (Bull. de la Soc. Anatom., p. 86, 1855).
[2] Wien. med. Wochens., Aug. 1877.   [3] Op. cit., p. 287.
[4] The following references may be made to recent articles on syphilis of the spleen and supra-renal capsules : Moxon, Syphilis of the Supra-Renal Capsules (Guy's Hospital Reports, 3d s., vol. xiii. p. 339, 1868); Huner, Syphilis of the Spleen (Deutsches Arch. f. klin. Med., Bd. v., S. 270, 1869); Besnier, Syphilis de la Rate (Dict. Encyc. des Sci. Méd., Art. RATE, 1874); Chvostek, Syphilis of the Supra-Renal Capsules (Wiener med. Wochenschr., Aug. 1877).

ment and their general character. It is now known, however, that the syphilitic lesions of the larynx may occur at any period of the general development of syphilis, without regard to the appearance of other lesions.

The superficial syphilitic lesions of the larynx include erythema, mucous patches, superficial ulcerations, and vegetations. The deep lesions are deep ulcerations, gummatous tumors, perichondritis and chondritis, caries, and necrosis.

The farther from the opening of the larynx is a lesion situated, the more serious is it. But the severity and threatening character of a lesion are by no means proportioned to its individual character. There is often more to be dreaded from a shallow mucous patch accompanied by œdema, than from a deep ulceration. The subjective symptoms connected with syphilis of the larynx are comparatively trifling. Quite a large and deep ulcer may exist without the patient being even aware of its presence. The invasion of the larynx is insidious, and the subsequent course of the lesions is chronic and devoid of pain. According to the views of some authorities, the parts of the vocal organism most often in contact during the performance of its function are most frequently attacked by syphilis. Hence the vocal cords and the arytenoids are the most susceptible regions (Bumstead and Taylor).

The lesions of laryngeal syphilis are rarely painful, excepting when the cartilages are attacked. There is rarely any cough, and but slight expectoration, this, if present, being scanty, mucous, or muco-purulent. The sputa may be tinged with blood from an ulcer, or may contain fragments of cartilage or bone. In the latter case they are apt to be fetid. The voice is rarely altered, although in some cases there may be hoarseness or whispering. Dysphagia may occur in rare cases where the disease is far advanced, or where the epiglottis is attacked. Dyspnœa is an important symptom. It may supervene on stenosis of the passage caused by œdema, vegetating growths, cicatricial contraction, and possibly spasm. Tracheotomy is sometimes called for, but it should only be employed at the last moment, since prompt and vigorous specific medication—if necessary, by the hypodermic method—will sometimes save an apparently desperate case.

In considering the special lesions of the larynx, it is scarcely necessary to more than mention the early and slighter affections. *Erythema* is easily made out when concomitant symptoms are present, or when a trustworthy history can be obtained. When the epiglottis is involved, it may become œdematous and much tumefied, and may assume a bilobed shape.

There has always been some question as to the relative frequency of *mucous patches* in the larynx, but recent writers, such as Krishaber, Mauriac, and Whistler, consider them tolerably frequent. They possess in general very much the same characters in the larynx as in the mucous membrane of the mouth; but the difficulty of examining them closely, and the more complicated arrangement of the parts, render them less easy of recognition in some cases.

The *superficial ulcerations* in laryngeal syphilis involve only the mucous membrane. They are very sluggish, persisting with slight change for an indefinite period. They are apt to be confounded with the ulcers of phthisis, but these begin in the ventricular bands, and are paler than the syphilitic lesions. The ulcers of phthisis are bathed in a copious, muco-purulent secretion, and are apt to be accompanied with decided swelling and œdema of the arytenoids. Finally, the concomitant symptoms of phthisis are likely to be found elsewhere.

The *chronic inflammation* of laryngeal syphilis may be an early or a late lesion; it is apt to be persistent, and to lead to thickening or hypertrophy of

the mucous membrane, quite a different symptom from the œdema some-times accompanying erythema. Operative interference is occasionally called for to relieve accompanying dyspnœa.[1] Chronic ulcers and occasionally vege-tations are found in connection with this form of inflammation, the favorite seat of vegetations being at the insertion of the inferior vocal cords.

The *deep ulcerations* of laryngeal syphilis may occur by extension from the pharynx, or by degeneration of gummatous deposit. They are insidious, and much destruction may occur in the epiglottis, the ligaments, and the vocal cords, without very marked symptoms. These ulcers, which present a similar appearance to those occurring on other mucous membranes, are sometimes mistaken for cancer; but in this disease the tonsils and submaxillary glands are apt to be affected at an early period with infiltration. Pain, sometimes extreme, is a symptom of cancer, but is absent in syphilis until the parts have been extensively destroyed.

Gummy tumors of the larynx are often single, and may attain a large size; but they may also be small and multiple. They generally tend to ulceration. A fatal termination may ensue in the course of these lesions from impediment to respiration, due to the size of the tumor, or to an acute œdema of the larynx. Türck has recorded a case of death from hemorrhage.

Perichondritis usually occurs from extension of an inflammatory or ulcera-tive process from the mucous and submucous tissues. The cartilage itself may be involved, in which case it is said that crepitation can be observed on palpation.

Caries, or true *necrosis*, when ossification of the cartilage has taken place, is a common sequel of invasion of the perichondrium by inflammation or gum-matous ulceration. Fragments of sequestrum may be expectorated, or, lodging in the air passages, may cause alarming or even fatal dyspnœa. Mauriac gives an account of a peculiar phlegmonous inflammation of the parts sur-rounding the larynx, secondary to the invasion and death of the cartilage.

Syphilitic aphonia has been observed from time to time. Its cause, when occurring in the earlier stages of syphilis, has, I believe, not yet been pointed out; but Simyan and Paget describe a paralysis of the vocal cords which has been observed in the later stages of syphilis. It is unilateral, and yields to specific medication.[2]

TRACHEA AND BRONCHI.—The syphilitic affections of the trachea and bronchi are naturally closely analogous to those of the larynx. The lower portion of the trachea is the usual seat of the disease. The lesions are com-monly developed in the submucous tissue rather than in the mucous mem-brane itself; they consist either of diffuse infiltration into the submucous

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[1] See the account of a case in which tracheotomy was performed four times in five years. Trans. Clin. Soc., vol. x., 1877.

[2] The following papers may be referred to for fuller details : Gerhardt und Roth, Ueber syph. Krankheiten des Kehlkopfes (Arch. f. path. Anat., Heft. xxii. 1861) ; Krishaber, Contribution à l'étude des troubles resp. dans les Laryngopathies Syph. (Gaz. Hebd., 1878, Nos. 45–47) ; Elsberg, Syphilitic Memb. Occlusion of Rima Glottidis (Am. Jour. Syph. and Derm., 1874) ; P. Ferras, De la Laryngite Syphilitique (Thèse de Paris, 1874) ; Krishaber et Mauriac, Des Laryngo-pathies Syph. pendant les premières phases de la Syphilis, Paris, 1876 ; Whistler, The Early Manifestations of Syphilis in the Larynx (Med. Times and Gaz., 1878, Nos. 1473 to 1484) ; Simyan, Syphilis Laryngée Tertiaire (Thèse de Paris, 1877) ; Mauriac, Sur les Laryngopathies Syph. Graves compliqués de Phlegmon péri-laryngien, Paris, 1876 ; Simyan et Paget, Des Paralysies du Larynx (Thèse de Paris, 1877) ; Dance, Éruptions du Larynx survenant dans la période secondaire de la Syphilis, Paris, 1864 ; Trélat, Sur la Trachéotomie dans les lesions syphilitiques des Voies Respi-ratoires (Bull. de l'Acad. de Méd., Déc. 8, 1868) ; Bryant, Trans. Clin. Soc. London, vol. i. 1868, p. 127 ; H. L. Williams, St. Barthol. Hosp. Rep., 1869, p. 124 ; T. G. Wollaston, Liverpool Med. and Surg. Rep., vol. iii., 1869, p. 20 ; Erichsen, Med. Times and Gaz., April 8, 1871 ; W. Stokes, Brit. Med. Jour., April 1, 1871.

tissue or of circumscribed gummatous tumors. In the bronchial tubes the lesions are apt to be found near the bifurcations.

The *symptoms* which mark the syphilitic affections of the trachea and bronchi vary somewhat according to the nature of the lesions. Their earlier appearance and progress are insidious, and patients are frequently ignorant of their existence. A slight difficulty of respiration, a little cough, and the feeling as of something in the air passages perceived about opposite the upper end of the sternum, comprise the ordinary symptoms. The respiration may also be a little harsh or hissing in some cases, there may be some oppression on going up stairs, or a sense of suffocation at night, with a dry cough. At a more advanced stage of the affection the cough is more frequent and trouble-some, and muco-purulent sputa, striated with blood, or nummular, yellowish-green sputa, are observed. Auscultation fails to reveal any abnormal respira-tory sound. The symptoms mentioned persist for some time and then begin to diminish, especially if appropriate medication is employed. The ameliora-tion is not permanent, however, for when cicatrization begins, the symptoms previously observed once more set in, only in a more marked degree, and with less hope of improvement through medication. One of the most important symptoms observed at this period occurs in the form of suffocative attacks coming on suddenly, and without any well-defined cause, and sometimes so severe and so frequently repeated as to endanger life. Lowering of the larynx and immobility of this organ during speech and deglutition, are likewise to be noted as important symptoms of tracheal syphilis at an advanced stage. In addition, a peculiar hardness of the trachea may be perceived by the touch, and a diminished degree of mobility on the part of this organ among the surrounding tissues. It is said that one may at times perceive the lesions *in situ* by the aid of a laryngeal mirror, but this view I fear will not often be granted excepting to the expert laryngoscopist.

When the disease affects the bronchial tubes only, the symptoms are some-what different from those described above. It was formerly supposed that the bronchial tubes were only affected secondarily from the throat, or at least subsequently to it, but this is very frequently not the case. The first symp-toms are very similar to those of ordinary catarrh. The voice is altered, however; there is continual dryness and irritation in the larynx, which gradually extends to the bronchial tubes. Patients suffer from a sensation of painful constriction over the sternum, with a dry cough. At a later period the sputa appear of a purulent character, and indicate suppuration. Hectic fever is now observed, if it has not previously appeared; dyspnœa is common; and the patient may finally die in an attack of suffocation. These affections are rare, and often fatal, especially when the trachea is involved, because of the difficulty of recognizing the disease in time to apply proper remedies.

The *diagnosis* of syphilis of the trachea and bronchi is chiefly made by ob-serving the symptoms of dyspnœa, a peculiar wheezing sound in inspiration —the voice preserving almost its natural timbre—pain, or a sensation of a foreign body at some point in the air-passages, and, subsequently, attacks of suffocation without appreciable pulmonary lesion.[1]

As to the *treatment* appropriate to these affections, it may be said that mer-cury is perhaps the best remedy, since iodide of potassium has been known in some instances to provoke œdema, which is likely to complicate matters.

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[1] For further information, especially as to the differential diagnosis of syphilis of the trachea and bronchi, reference may be made to Lancereaux (op. cit., p. 321), and Biermer, Mém. sur les Ré-tréciss. de la Trachée et des Bronches (Gaz des Hôpitaux, Sept. 9, 1869); two cases, one by Mois-senet, the other by Demarquay, where fatal dyspnœa resulted from cicatricial stenosis of the air-passages following the healing of a syphilitic lesion, are given in the Annuaire de la Syphilis, 1858, p. 324, and are quoted by Bumstead and Taylor (op. cit., p. 624).

Astringent and sedative sprays may likewise be employed. Treatment, to be effectual, must be timely and thorough.[1]

Lungs.—Two syphilitic affections of the lungs are commonly described, *diffuse or interstitial pneumonitis*, and *circumscribed or gummatous pneumonitis*. Diffuse pneumonitis may be situated in either the superior, middle, or lower lobes, without, however, invading any considerable portion of tissue. The affected portion of the lung is firm, hard, elastic, friable, impermeable to air, and, consequently, non-crepitant. Circumscribed pneumonitis, which is rather less rare than the diffuse variety, is characterized by the formation of gummy deposits in the lung tissue at one or more points, without any particular locality of predilection. When, however, the gummy tumor is found in the upper lobe, it is at its base rather than at its apex, contrary to what occurs in the case of tubercular deposits. Gummy tumors of the lung are generally firm, smooth, and circumscribed by indurated fibrous tissue; they undergo necrosis at an early date, with fatty or cheesy degeneration beginning at the centre of the nodule. Subsequently absorption may occur, partially or entirely, but more commonly the softened gummatous matter is evacuated by the bronchial passages, leaving a cavity circumscribed by fibrous tissue. Cicatrization may then take place.

The *symptoms* of syphilis of the lung are not characteristic in any way, and the affection is therefore very difficult of recognition. The diagnosis must depend, to a very considerable degree, upon the history of the case and upon the concomitant symptoms. At the same time, there are certain symptoms manifested which may indicate, in a doubtful case, the presence of a syphilitic lesion. For example, a certain degree of dulness on percussion, with a blowing sound and without febrile reaction, the symptom being limited to one of the lower lobes or to the middle lobe, in a cachectic individual the apices of whose lungs are intact while his liver is diseased, constitutes a strong presumption in favor of a syphilitic pulmonary affection. The sudden appearance of abundant sputa, and the seat of alteration being limited in extent, and particularly confined to one side of the thorax alone, are circumstances which likewise aid in the diagnosis. Tuberculous disease of the lung, which is most likely to be confounded with the affection under consideration, is marked not only by a more rapid evolution and more extensive involvement of the organ, but chiefly by making its onset in the apices of the lungs. When, however, the syphilitic lesion happens to occur in the same part, the diagnosis becomes extremely difficult, even to the skilled clinician.

The *prognosis* of lung syphilis is serious, not as much because of the severity of the lesions themselves, as because they are ordinarily accompanied by other visceral lesions, and because they usually occur at an advanced stage of syphilis, when the system is more or less broken down by the disease.

The syphilitic phthisis and asthma of some writers are not, it should be here remarked, independent affections, but are in reality symptoms of the two forms of syphilitic lung disease described, and particularly of the ulceration and stenosis which sometimes occur.

The relationship between syphilis and tuberculosis of the lung has sometimes been the subject of discussion, but although the facts in our possession do not at present war-

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[1] See Cohen, Diseases of the Throat and Nasal Passages, New York, 1879 ; and the article on Injuries and Diseases of the Throat in Vol. V. of the present work. Also Trélat, De la Trachéotomie dans les Lésions Syphilitiques des Voies Respiratoires (Gaz. Hebdom., 1869, Nos. 17, 18, et 19).

rant any very positive assertion, yet I think I may safely say that these two affections are never connected together as direct cause and effect. It is true, however, that the cachexia produced by syphilis may favor the deposit of tubercle in the lungs of an individual thus predisposed, and also, on the other hand, it is very possible that the irritation of a diseased lung may predispose to the deposit of syphilitic material, on the principle of the *locus minoris resistentiæ*. There are no facts, however, as yet, to support this latter hypothesis.[1]

Syphilis of the Circulatory System.

Heart.—The syphilitic lesions of the heart are of two kinds, diffuse and circumscribed. The former, similar in all respects to diffuse syphilitic myositis, is rarely met with, excepting in connection with the latter (gummatous) form.

The symptoms of syphilitic disease of the heart have not as yet been very exactly made out, because of the small number of cases, and because of the brief period during which these have been under observation. They are of two kinds, functional and physical. Palpitation is almost always present, with irregularity of pulse, and a feeling of weakness. During the latter period of life, severe pain and constriction in the precordial region are observed. There is a certain amount of discoloration (cyanosis) of the face, the lips are slightly cyanosed, and there is a slight degree of œdema. The most marked physical sign is dulness on percussion over the precordial region, and a dull sound, with occasionally a slight murmur accompanying the first sound of the heart, most clearly perceived toward the apex. The veins of the neck and of the extremities are apt to be distended. The progress of the affection is slow, tedious, and insidious.

The *symptoms* of cardiac syphilis are not very strongly differentiated from those of other heart affections. For this reason, in order to make a positive diagnosis, the general affection must usually be recognized. It may be asserted, however, that syphilitic heart affections form a class in themselves which may in very many instances be differentiated from those of a rheumatic character. They usually manifest themselves only by the symptoms of oppression, dyspnœa, irregularity of cardiac action and irregularity of pulse, while the rheumatismal affections which are specially apt to attack the valves of the left heart, particularly the mitral, generally give rise to a well-marked murmur, and are sooner or later accompanied by œdema. Rheumatismal and alcoholic myocarditis, and secondary dilatations of the cardiac cavities, are like the syphilitic lesions in not giving rise to murmurs, and also in causing asystolic symptoms at a certain period. The antecedents of the patient and the presence or absence of cachexia will serve to aid the diagnosis in such cases.[2]

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[1] The following papers may be referred to for fuller details regarding syphilitic disease of the lungs: Gintrac, Phthisie Syphilitique (Gaz. Hebd., 1877); Hertz, Ein Fall von Aneurysma und Pneumonia syphilitica (Archiv f. path. Anat., 1873, S. 421); Lancereaux, Des Affections Syphilitiques de l'Appareil Respiratoire (Arch. Gén. de Méd., 1873); Id., Note sur un Cas de Syphilis Pulmonaire, suivie de réflexions sur la Syphilis des Viscéres et les erreurs dont elle est l'objet (Bull. de l'Acad. de Méd., 2e Série, t. vi. No. 43); Aufrecht, Zwei Fälle von syphilitische miliar Tuberculose (Deutsche Zeitschr. f. prakt. Med., 1874, No. 26); Fournier, De la Phthisie Syphilitique (Gaz. Hebdom., 1875, pp. 758, 773, 802); Thoresen, Syphilis und Phthisis (Norsk Mag. f. Laegevid., 1875, and Schmidt's Jahrbücher, 1875); Rollet, Lungensyphilis (Präger Vierteljahrs., 1877, S. 13, from Wien. med. Presse, 1875, No. 47); Tiffany, Syphilis of the Lung (Am. Jour. Med. Sci., July, 1877, p. 90); also, leading article in reference to discussion in London Pathological Society (Lancet, vol. i., 1877, p. 354).

[2] See Lancereaux, op. cit., p. 295 et seq.

BLOODVESSELS.—Syphilitic lesions of the veins are so rare as to be practically almost unknown. Gosselin[1] has reported two cases where small gummata were found in the connective tissue of the external covering of the saphenous veins, forming painful cord-like tumors under the skin.

The syphilitic lesions of the arteries are primary or secondary (that is, resulting from lesions in the immediate vicinity). Verneuil, according to Jullien, gives a case of the latter variety, where perforation with excessive hemorrhage resulted from the extension of a phagedenic ulcer. The tissues surrounding the artery and its own coats were involved. Primary syphilitic disease of the arteries is commonest in the smaller vessels of the brain. Pathologically the affection consists in a thickening of the arterial walls by an infiltration of small cells, especially into the tunica intima. The process differs from ordinary atheroma by its most common localization in the smaller arteries; by its more rapid extension, making as much progress in months as atheroma does in years; by its tendency to narrow the calibre of the vessels, while atheroma tends to dilatation with thinning of the vascular walls. Syphilitic lesions of the bloodvessels betray their presence by the trophic visceral affections to which they give occasion. Obliteration of the carotid causes pain in the head, epileptic attacks, and enfeeblement of the cerebral functions, followed by coma and death. In cases where the cerebral arteries, strictly so-called, are involved, severe headache, almost always frontal, worst at night, and joined to various alterations in the psychical functions and those of the organs of sense, shows ischæmia of the brain, and serves as a prodrome of coming mischief. At a later stage an apoplectic attack, with or without loss of consciousness, and more or less loss of motion, or more frequently with aphasia, unilateral paralysis, etc., shows the indirect influence of syphilitic vascular disease. Delirium may also supervene.

The *diagnosis* of syphilitic arteritis must be made with the aid of the patient's history.

The *prognosis* is a matter of grave importance; the question whether syphilis may be a cause of aneurism has for some time engaged attention, and has been at length decided positively in the affirmative.[2]

SYPHILIS OF THE LYMPHATIC VESSELS AND GANGLIA.

Syphilis may affect the lymphatic vessels and ganglia both in its earlier and later stages. The adenitis accompanying chancre has already been mentioned. It is limited to the vessels and ganglia in the immediate neighborhood of the initial lesion, and as it often lasts until after every trace of the chancre has disappeared, it may at times serve as an important aid to diagnosis in difficult cases.

The adenitis accompanying the early generalized outbreak of syphilitic symptoms appears at various points simultaneously, the glandular engorgement being most marked in the sub-occipital, mastoid, epitrochlear and sub-maxillary regions. Its appearance is contemporaneous with that of the earliest syphilitic eruptions, that is, from the sixth to the twelfth week of the disease. It has been asserted indeed that the glandular engorgement is due to the influence of the eruption, but this is disproved by the fact that it may occur without the presence of any skin manifestation.

The generalized glandular engorgement is very much the same in appearance and symptoms as the localized glandular involvement of chancre. The

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[1] According to Jullien, who gives no reference.
[2] See Wilks and Moxon, Lectures on Pathological Anatomy; Lancereaux, Artérite Syphilitique (Gaz. des Hôp., No. 21, 1876).

ganglion grows little by little, increasing slowly in size without inflammatory reaction until a pea or filbert-sized tumor is observed, movable, indolent, and disappearing slowly, only perhaps after months. Treatment often fails to quicken its disappearance.

Lymphangeitis is sometimes observed in connection with this glandular engorgement. It is more apt to be met with on the inner side of the upper and lower limbs. The vessels appear as cords under the skin, with enlargements at various points.

The late syphilitic affections of the lymphatic glands affect those which are deeply situated. They have only been studied during the past few years. The glands most commonly affected are the abdominal, vertebral, lumbar, iliac, and femoral; then the bronchial and mesenteric glands; lastly those of the limbs.

These lesions are not uncommon in the later periods of syphilis. They are apt to occur in connection with visceral lesions, but they may occur independently. They show no sign during life, and are usually found only on post-mortem examination.

SYPHILIS OF MUSCLES AND TENDONS.

MUSCLES.—I have already, in treating of the general condition of the system before and during the outbreak of generalized symptoms, spoken of the peculiar form of muscular contraction due to the influence of the syphilitic poison.[1] It therefore remains here only to describe the muscular pains of syphilis, and the gummatous tumors of the muscles.

In the early stages of the generalized period of syphilis, certain vague, shifting, rheumatoid pains are observed, seated chiefly about the articulations, or following the course of the muscles and tendons. At a later period, also, somewhat similar pains are noticed at times, involving the muscles, tendons, and fibrous tissues generally. These pains differ, however, from those of the early period of syphilis, in being fixed and persistent, instead of coming and going, now in one place and now in another, like the early lesions. Both the early and the late forms of syphilitic rheumatoid pains are amenable to treatment.

Syphilitic tumor of the muscles has been well described by Bouisson,[2] who divides the affection into three stages. In the first, the muscle becomes the seat of a perceptible, circumscribed swelling, without pain. The second stage sees the gradual softening of the tumor, the contents of which become a gummy and stringy liquid. Sometimes the tumor, instead of following the ordinary chronic, indolent course, assumes acute symptoms, becomes painful, hot, red, etc., presenting every appearance of an acute abscess. Bouisson thinks that some cases of pelvic abscess, of psoitis, and of inflammation of the iliac muscle, may be referred to this disorder. In the third stage, the tumor no longer softens, but becomes of an almost cartilaginous hardness, and even bony. These muscular ossifications may occasionally be accompanied by exostoses.

The tumors under consideration may be observed in the muscles of the thigh or calf, in the trapezius, sterno-mastoid, pectoralis major, etc. They are commonest, however, in the tongue, though they may be met with anywhere. Occurring in the larynx, they may be mistaken for laryngeal phthisis.

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[1] See p. 487. In addition to the references there given the following may be mentioned: Notta, Sur la Retraction Musculaire Syphilitique. Archives Gén. de Méd., Déc. 1856.

[2] Arch. Gén. de Méd., Déc. 1850.

As already mentioned, bony transformation is the occasional result of muscular syphilis.

The course of this affection is slow and insidious. Very often the patient himself is not aware of its existence even after it has lasted a considerable time. The pains which are frequently experienced in the earlier stages of the disease, are apt to be considered rheumatic. Afterwards, in the case of gummata, when the tumor softens it is taken for an abscess. I have seen this mistake made repeatedly, and have had patients present themselves with gummata of the muscles which had been treated with poultices for a considerable period, without the true nature of the lesion having been suspected.

As a rule, syphilis of the muscles tends to get well under appropriate treatment. The diffuse form, however, may result in atrophy or destruction of some of the muscular fibre, and thus lead to permanent retraction.

The diagnosis of the syphilitic lesions of the muscles is not difficult when the concomitant symptoms, usually among the later manifestations, are taken into account. Abscess and cancer, for which the softened gummatous lesions are occasionally mistaken, may be distinguished by the characteristics pointed out under gummata of the skin.

TENDONS.—The syphilitic affections of the tendons resemble closely those of the muscles. They consist either in a partial thickening, or in the presence of small gummatous nodes in the structure of the cord-like tendons, or of the membranous aponeuroses.

Those tendons which are most thick and firm are most frequently attacked. The tendo Achillis and the tendons of the femoral biceps and quadriceps are most apt to be the seat of the affection. Nélaton observed two gummy tumors developed in the latter tendon which simulated a foreign body in the knee. In another case the tumor, which occupied the rectus muscle of the thigh, became the point of departure for a hydrarthrosis, which might easily have been mistaken for a white swelling.[1]

The syphilitic affections of the aponeuroses are not usually painful. Those situated in the tendons of muscles give rise to pain when the muscle is used, sometimes to a greater or less extent preventing movement. Usually subcutaneous, these lesions show themselves at first as abrupt, sharply-defined, hard, small nodules. At a later period they soften, the skin covering them becomes red and inflamed, and ulceration sets in, giving exit to the softened gummatous product, which, it must be noted, is not purulent, but is thin and colorless, or slightly tinged with blood. The ulcers thus formed are slow to heal, but finally they get well without retraction having taken place in the tendon. After suppuration has occurred, it is not difficult to make the diagnosis, but in the earlier stages of syphilitic disease of the tendons, it is often difficult to distinguish the lesions from the ordinary " ganglions" found in the same localities. They are reducible, however, under appropriate treatment, and also run a very different course. Neuromata, which may sometimes be confounded with syphilitic lesions of the tendons, are painful, and their seat also is usually different.[2]

The prognosis of these affections is favorable. They do not lead to any permanent injury of the parts affected.

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[1] Saint-Arroman, Thèse de Paris, 1858.
[2] See Notta, Recherches sur une affection particulière des Gaînes Tendineuses de la Main, caractérisée par le développement d'une nodosité sur le Tendon des Fléchisseurs des Doigts. Arch. Gén. de Méd., t. xxiv., 4e sér., p. 142.

Syphilis of Periosteum and Bone.

Lesions of the periosteum and bones are frequent in syphilis. Formerly they were supposed to belong only to the later stages of the disease, but they are now known to occur quite early, in some cases being coincident with the papular syphilodermata.[1]

Osteocopic Pains.—The name "osteocopic" (see page 481) has been given to certain painful sensations observed in the bones, not merely in syphilis, but in other affections. However, as they are much the most commonly met with in syphilitic patients, the name has come to be associated exclusively with the idea of syphilis, particularly with the later periods of the disease.

These pains occur spontaneously; they are aggravated by pressure and are commonly found in the more superficial bones, such as those of the cranium, the tibia, clavicle, radius and ulna, sternum, etc.; their constancy distinguishes them from the more wandering pains of rheumatism. One of the most marked characteristics of the osteocopic pains of syphilis is that they acquire their maximum intensity toward midnight or one o'clock in the morning. Ricord said that this was due to the warmth of the bed, and asserted that individuals, such as bakers, whose occupation required them to turn day into night, experienced osteocopic pains when they went to bed, that is in the daytime. This explanation, however, does not fit all cases, since in many instances the pains return at a given hour, whether the persons are in bed or not.

The pains are at first moderate, but gradually become more severe, and are occasionally so excruciating as to wring cries of pain from the sufferer. In some cases they are the only sign of the disease, but more frequently are merely the indication and symptom of a material affection of the bone. It is not unusual for osteocopic pains to fix themselves at some particular point in a bone, and for periostosis or exostosis to be subsequently observed in the same situation.

Although commonly occurring at a late period in the evolution of syphilis, these pains may be felt at any, even a very early stage. From the rheumatic pains of syphilis, the osteocopic pains are distinguished not only by their fixity, as before mentioned, but by being aggravated by pressure. The rheumatic pains are wandering, and are unaffected by pressure.

Diffuse Gummatous Infiltration.—This form of syphilitic bone disease[2] is characterized by a more or less general deposit of gummy matter, diffused through the deep or superficial portions of the bone substance. This is soon followed by absorptive action, which, when influenced by treatment, may lead to the disappearance of the syphilitic deposit, or, left alone, may result in the death and separation of a sequestrum of bone. Sometimes the affection takes a different line of action, and, instead of causing destruction of a portion of the bone, leads to the throwing out of new osseous tissue. In the body of the bone this process is called *osteitis condensans;* on the surface it gives rise to *osteophytes* and *exostoses.*

Productive osteitis is a constant accompaniment of neoplastic action, occurring in the immediate neighborhood of the neoplastic points, and as a consequence of irritative action of moderate intensity. As a result of this

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[1] See Mauriac, Mémoire sur les Affections Syphilitiques Précoces du Système Osseux. Paris, 1872.

[2] I have followed Jullien (Traité Prat. des Mal. Vénér.), in this description of the bone lesions of acquired syphilis.

productive inflammatory action, the lacunæ and cavities left by the breaking down of the syphilitic deposit are filled up with new material, the normal density of the bone being by this means again restored or even surpassed. In the latter case eburnation begins, the Haversian canals are closed, and hyperostosis may take place, reaching occasionally such a degree that, in the skull, the bones may be nearly an inch thick. When this process goes a step further, nutrition is interfered with, and the affected portion of bone dies and is thrown off as an eburnated sequestrum.

Fig. 331.
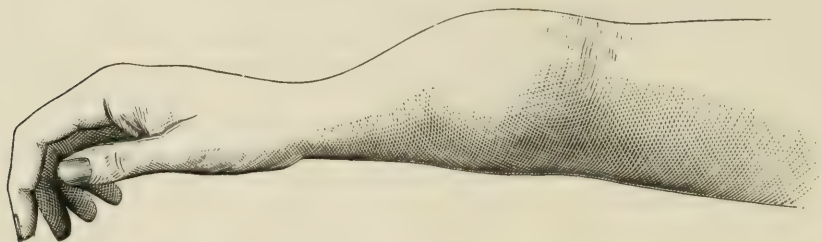
Periostosis (node) of bones of forearm due to hereditary syphilis.

When superficial, the new formation arises from the periosteum, or at least from its medullary layer, and is therefore sometimes called *periostosis*. (Fig. 331). The tibia is the commonest seat of this diffuse form of syphilitic bone disease. One form of periostosis, that in which the new bony deposit adheres rather loosely to the body of the bone, is called *epiphyscal exostosis*. Cellular at first, this deposit becomes in time compacted by the deposit of new lamellæ about the original trabeculæ, so as to lead even to eburnation.

On the other hand, the exostosis is called *parenchymatous* when the tumor, though visible externally, is the consequence of an osseous deposit in the thickness of the bone itself.

CIRCUMSCRIBED GUMMATOUS INFILTRATION.—On the surface of the bone, the gumma presents the appearance of a sharply circumscribed lesion. It has been chiefly studied in the form in which it appears upon the cranium. The substance of the lesion, gelatinous in appearance, accumulates between the bone and the dura mater on one side, or between the bone and the periosteum on the other, and penetrates the osseous substance like a wedge, causing its progressive absorption. When two gummata happen to occur opposite one another, and to meet in the diploic structure, perforation is the result. (See Fig. 332.) Under treatment, circumscribed gummata of the bones gradually undergo lardaceous or caseous metamorphosis, and are absorbed, leaving, however, a depressed stellar cicatrix, rendered more conspicuous by the plastic deposits about the periphery caused by the irritation. Virchow considers this the result of a process to which he has given the name *dry caries*, but in the opinion of some other syphilographers the gummatous process is sufficient to account for the appearances presented.

The evolution of the gumma, as this takes place in the interior of the bones, particularly of the long bones, is not very well understood. Ricord's plates, however, show that the lesion may occupy the medullary cavity, where it presents the appearance of a lardaceous mass around which the compact tissue is redder and more porous. Occurring in the substance of the spongy

tissue of the ends of the long bones of the hand and foot, especially in very young children, the gumma may often assume the appearance of *spina ventosa*.

Fig. 332.
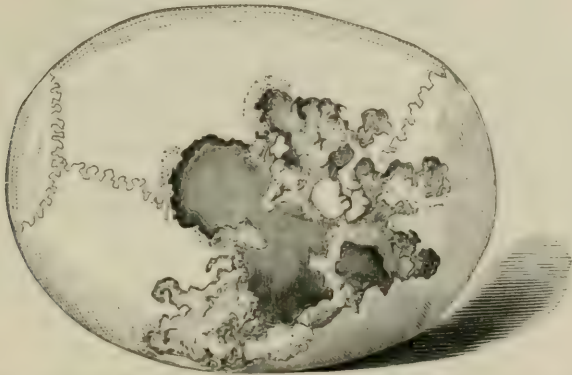
Necrosis of cranium with loss of entire thickness of bone, in places, following gummatous disease. (From a specimen in the Mütter Museum, College of Physicians of Philadelphia.)

The compact tissue and the periosteum, forced outwards, distend like a globe of molten glass at the breath of the glass-blower, and form a shell with extremely

Fig. 333.
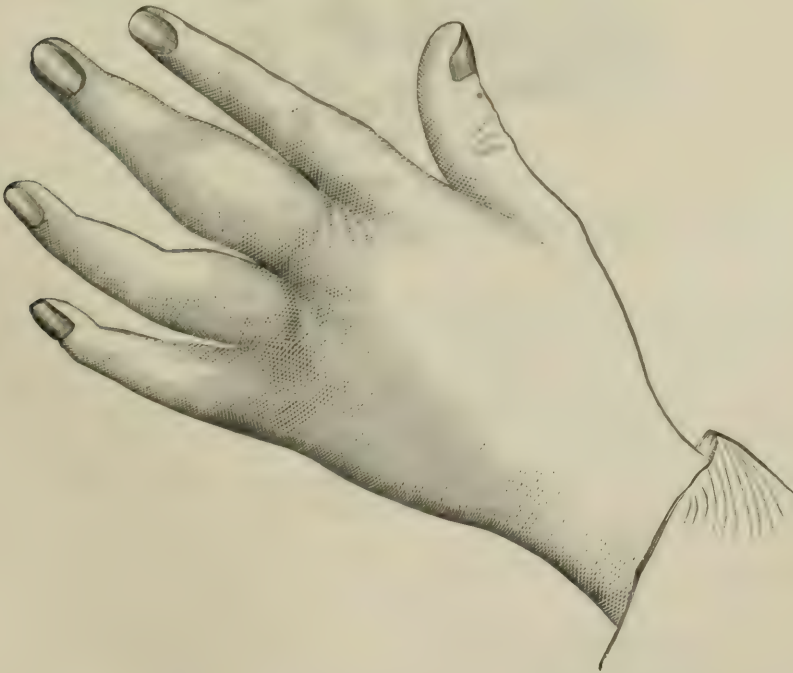
Hereditary syphilitic disease of bones of hand. (Dactylitis syphilitica.)

thinned walls, as shown in Fig. 333, which represents a case occurring in a young colored girl under my care at the University Hospital. This lesion of

slow evolution disappears, under prompt treatment, by resorption of the neo-plasm, leaving no trace of its former presence. Left alone, it may lead to serious disfigurement.

As has been observed, necrosis is a not unfrequent result of gummatous affections of the bones. Suppuration, phlegmonous swellings, openings with everted edges, fistulæ, loss of substance in the skin, etc., are among the visible results of syphilitic necrosis, not differing, however, in this respect from the effects of other forms of necrosis. Sometimes a sequestrum is surrounded and inlaid as it were in the hypertrophied superjacent tissues, as in a portion of eburnated bone surrounding it. Syphilitic necrosis may extend by the formation of new gummatous deposits, giving the edge of necrosed bone a peculiar "polycyclic" appearance, which is quite characteristic and most apt to be observed in the skull (Fig. 334).

Fig. 334.

Necrosis of cranium following circumscribed gummatous disease. (From a specimen in the Mütter Museum, College of Physicians of Philadelphia.)

An absurd superstition still prevails among the ignorant regarding the influence of mercury in causing bone troubles. It is hardly necessary to say that this is entirely without foundation. On the one hand, abundant statistics exist to show that untreated syphilis is more likely to show bone disease; and, on the other hand, it has been found that miners and workers in mercury are not any more subject to osseous affections than other persons.

The following tables from Jullien show the comparative frequency of the various syphilitic bone affections and their commoner localization:—

COMPARATIVE FREQUENCY OF VARIOUS FORMS OF SYPHILITIC BONE DISEASE.

(*Jullien*).

Osteitis and osteo-periostitis . . .	12 cases
Circumscribed gummata	11 "
Necrosis (elimination of bone) . . .	20 "
Exostosis	15 "
Periostosis	7 "

Locality of the above lesions.

Nose	19	cases
Tibia	15	"
Palate	15	"
Sternum	5	"
Clavicle, maxillary, each	2	"
Frontal	2	"
Parietal, vertebra, each	1	case
Scapula, ulna, radius, each . . .	1	"

SYPHILIS OF THE CERVICAL VERTEBRÆ. — When the lesion is seated in the body of a vertebra, towards its anterior aspect, it forms a tumor in the pharynx. Together with difficulty of deglutition, which may even amount to danger of suffocation if too large a bolus of food is ingested, there are pain, chiefly nocturnal in character, difficulty of motion, and the characteristic attitude of cervical anchylosis. Death from inanition or dyspnœa may result if the tumor does not soften and break down into a pharyngeal abscess. The prognosis is even graver when the lesion is seated in the medullary cavity. The symptoms of compression, paralysis, or irritation of the spinal cord are very difficult of diagnosis, their cause, if not their nature, remaining obscure. If the lesion is confined to the transverse apophyses, some of the spinal nerves may be compressed, giving rise to difficulties of function, etc., according to the nerve pressed upon.[1]

SYPHILIS OF THE CRANIUM.—The headache which accompanies the appearance of gummata of the cranium, is so severe that it often leads to the suspicion of deeper lesions. The patient is driven almost frantic by the pain of the bone lesion combined with that of direct pressure upon the cranium. Circumscribed gummata appear as slowly growing tumors on the forehead, temples, etc., and may attain considerable size, having hard, raised borders of bony tissue, the result of the productive osteitis caused by the irritative influence of the tumors. These tumors have little tendency to ulceration; they disappear very rapidly under the influence of iodide of potassium, but the bony growth around them, if well formed, remains. Relapse, however, takes place with great facility; the swelling begins to increase again as soon as the iodide of potassium is stopped, and these tumors may thus come and go for years.

Diffuse gummatous infiltration of the cranial bones may lead to extensive ulceration and loss of substance, with denudation of the dura mater, and occasionally modification in the form of the cranium, through contraction following the absorption of bony tissue (see Fig. 332).

Surgical interference in these cases should be undertaken only with great caution. When, however, a sequestrum keeps up irritation by its presence, its removal is justifiable and desirable. Iodide of potassium should be persistently administered in the mean time.

SYPHILIS OF THE BONES OF THE ORBIT.—The recognition of these lesions is extremely difficult, especially when the symptoms are not marked, being limited perhaps to slight œdema of the eyelids with local pain. Under these circumstances simple neuralgia is often diagnosticated, and quinine is administered to the detriment of the patient. This mistake may be avoided by taking note of the nocturnal character of the pain, and by exploring the interior of the orbit with the index finger, as far as possible, when increasing

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[1] For a striking case of involvement of the lower dorsal or lumbar vertebræ, see Fournier, Cas du maladie de Pott d'origine syphilitique. Ann. de Derm. et de Syph., n. s. t. ii. p. 19

tenderness of the periosteum will be observed. When the upper lid is much swollen, the eyeball projecting, and the orbital periosteum elevated, the history will generally confirm the suspicion of syphilitic disease thus aroused, and the result of treatment will confirm the diagnosis.

SYPHILIS OF THE MAXILLARY, PALATE, AND NASAL BONES.—The maxillæ are not unfrequently attacked, usually in the superior alveolar processes. The teeth loosen, the gums become red and swollen, and ulcers appear, which pour out a peculiarly nauseating discharge. The fetor of the breath, and the difficulty of speech, mastication, and deglutition, make this affection most painful and disagreeable to the patient and to those around him. Serious deformities often result from the loss of portions of the maxillæ, teeth, etc., but these can almost always be remedied by artificial appliances.[1]

When the palate is attacked, the disease may be so insidious in its onset as to show no sign until perforation is on the point of taking place. Fortunately, if only a small portion of bone is thrown off, advantage may be taken of the tendency of the soft parts to heal and cover the deformity, and by judicious stimulation the granulating edges may sometimes be made to join and afford membranous occlusion to the nasal passages. Occasionally, however, the gummatous growth penetrates with great rapidity, involving the palate and bones of the nose, and resisting all treatment until the bones are largely destroyed and until hideous deformity results.

When syphilis attacks the nasal bones, it is usually at first localized in the septum. Severe osteocopic pains may accompany the appearance of the lesion, these, together with coryza, nasal tone of voice, muco-purulent discharge, ozæna, and elimination of bits of bone, being among the first symptoms of the disease. Necrosis of the various bones of the nose, with flattening of the bridge, is a common effect of syphilis, the vomer, however, usually remaining intact.

The treatment of syphilis of the nasal bones should be prompt and thorough. In addition to the use of iodide of potassium internally, frequent disinfectant injections are to be employed, such as dilute liquor sod. chlorinat., solutions of salicylic acid or chloral (5 gr. to f℥j), etc.

SYPHILITIC DACTYLITIS.—Under this designation Dr. R. W. Taylor, of New York, described in 1871[2] a rare affection of the fingers and toes which had previously been alluded to by one or two writers, but which had never been fully studied. The affection is caused by both hereditary and acquired syphilis, the latter form, that under consideration, being much the more rare, and less than twenty-four cases having been recorded. There are two varieties: (1) that in which the subcutaneous connective tissue and the fibrous structures of the joints are involved; and (2) that in which the morbid process begins in the bones and periosteum, secondarily implicating the joints, and perhaps accompanied by deposit in the subdermal connective tissues.

The lesion develops slowly, the affected member gradually increasing in size, and becoming hard and firm. When the toes are affected, they are swollen uniformly throughout their entire length, but in the fingers a single phalanx is apt to be attacked, almost invariably the proximal one. The affected member is reddish or violaceous in color, and is firm to the touch, resistant, and tense. The swelling is usually developed painlessly, but there is sometimes a dull aching sensation. The periosteum is affected in this form

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[1] See Jullien, op. cit., p. 875 ; also works on operative dentistry.
[2] Am. Journ. Syph. and Derm., vol. ii., 1871, p. 1. See also Wigglesworth, Case of Dactylitis Syphilitica, Amer. Journ. Syph. and Derm., vol. iii., 1873, p. 142.

of dactylitis, but the bone is implicated very slightly if at all. The joints are involved within a few weeks after the development of the affection, the movements, at first hindered by the swelling and infiltration of the soft parts, becoming unnaturally free. Sometimes there are slight hydrarthrosis and crepitation in the joint. A single finger or toe, or several, may be involved, or one or both hands or feet, one toe being attacked after another, or several simultaneously. The disease runs a chronic course. There is no tendency to ulceration. There is generally complete restoration to the normal condition if treatment is instituted in good time. In neglected cases, however, the joints may be rendered permanently useless, and the bones may remain enlarged.

The second form of syphilitic dactylitis is sharply limited to the bone, and is due to either periostitis or osteo-myelitis. The affection may progress rapidly, slowly, or with intermissions. The earlier after infection that the lesion occurs, the more acute is its course. Usually a single phalanx, the proximal most commonly, is affected, becoming greatly swollen, assuming an acorn or balloon shape, and being hard and tense, while the superjacent integument remains unchanged, or smooth and red if the process has gone on rapidly. More than one phalanx may be affected, or several fingers or toes, on one or both hands or feet. The hands are the more usually attacked.

The joint structures are usually much thickened. After the dactylitis has lasted for about a month, the surgeon may detect crepitation from friction of the articular surfaces, the result of erosion due to impaired nutrition. Motion of the joints may be diminished or may be unnaturally free.

These bony swellings are very indolent. The gummy material may be gradually absorbed after a time, or it may soften and be discharged through a sinus, while the bone itself may be permanently altered in size and shape, and the function of the finger greatly impaired. There is little or no pain.

The affection is one of the late manifestations of syphilis, commonly occurring between the fifth and fifteenth years. Exceptionally it appears early, one case having occurred in the eighteenth month after infection.

The early recognition of both forms of dactylitis is a matter of great importance, as early and efficient treatment is necessary to prevent permanent deformity. The subcutaneous variety in its early stage might be mistaken for paronychia, but the absence of acute inflammatory symptoms, especially pain, establishes the diagnosis. The subacute character of dactylitis will also serve to distinguish it from gout. When several joints are attacked, rheumatoid arthritis might be suspected, but here also are acute inflammatory symptoms and pain, which are absent in dactylitis. The two affections do not attack the phalanges in the same manner, and dactylitis early tends to characteristic deformity. Enchondromata or exostoses, which might be mistaken for dactylitis, show more localized swellings, limited to a portion of the circumference of the bone. The prognosis of dactylitis is favorable if early "mixed" treatment is employed. Pressure with mercurial plaster spread on chamois skin is sometimes beneficial.

SYPHILIS OF THE ARTICULATIONS.

The study of syphilitic arthritis was first entered upon by Ritchet in his classical monograph published in 1853,[1] but the knowledge of the subject has been increased since then by the publication of several papers by Lancereaux and others.

[1] Mémoire sur les tumeurs blanches.

Syphilitic arthritis is a very late lesion of syphilis, often following ten, twelve, or even twenty years after infection, and differing from the early joint affections in this point, among others, namely, that it is commonly confined to a single articulation. The knee-joint, and especially the left, is the commonest seat of the affection; less frequently the wrist, elbow, ankle, temporo-maxillary articulation, hip, etc., are affected.

Pathologically, syphilitic arthritis originates either in lesions of the synovial and fibrous tissues, or in lesions of the bones and periosteum. As it presents itself in the sub-synovial cellular tissue and in that of the capsule, the syphilitic lesion takes the form of small, yellowish, dry, elastic, rather soft masses. A secondary lesion is erosion of the cartilages, due in all probability to the fact that the synovial and fibrous tissues upon which they depend for nutrition are diseased. There is almost always effusion into the affected joint. In one case where an examination was made, the effused fluid proved to be thick, stringy, cloudy, and very fibrinous. Under the microscope the fluid was seen to contain amorphous globules, epithelial cells, and altered blood globules, contained in an abundant albuminous mesh-work.

The bone lesions which occur in connection with syphilitic articular disease take the form of swellings—uniform hyperostoses of the spongy portions of the bones, due to a more or less intense osteo-periostitis. It is rare that the entire articulating surface is altered, the disease being usually confined to a circumscribed portion.

In Jullien's opinion, late synovitis may occur as a remote result of early syphilitic troubles in the joint. In any event the affection begins slowly and insidiously, and is at first unrecognized. After a time, a certain stiffness or tension is observed in the joint; then effusion takes place. The intermittent disappearance and reappearance of the congestive symptoms which give rise to this hydrarthrosis are among the surest signs of the syphilitic nature of a given case. Palpation reveals in some instances the existence of sclerosed patches in the synoviæ—small, soft, rounded gummata of the periarticular tissues. Besides these, all the ordinary signs of hydrarthosis are present. In addition, there is very little reaction, and hardly any pain, either spontaneous or aroused by pressure, or by the movements of examination. If in addition to these symptoms there are general signs of syphilis, and if the disease yields quickly to specific treatment even although it may have lasted for some time, the case is certainly one of syphilitic arthritis.

Although facts are wanting to prove the proposition, yet it is safe to say that the synovial form of syphilitic arthritis is benign, and without tendency to ulceration or suppuration.

The osseous variety, however, is more serious. It may appear suddenly with severe pain, generalized at first over the joint, but soon concentrating itself. At times this may be excessive, but usually it is not extreme, and it comes on at night to disappear with the morning. The diagnosis will be based on an examination of the osseous extremities; the roughnesses, the nodes of which they are the seat, not less than their enlargement, are characteristic. Occasionally some elongation of one of the bones entering into a joint takes place. The effusion about the joint is less marked than in the other form of arthritis, unless when both forms exist together, which is not rare. It is generally necessary to immobilize the affected limb in this form of syphilitic arthritis, and unless heroic antisyphilitic treatment is employed, serious deformity may result.

The usual treatment of syphilitic arthritis is the administration of iodide of potassium in large doses, that is, from half a drachm to a drachm and a half daily. To this mercury may be added, and in many cases general tonics are also required. Locally, strapping may be resorted to with the emplastrum de

Vigo, or emplastrum ammoniaci cum hydrargyro, with which I have some-
times advantageously combined graduated compression by means of the rubber
bandage. Large blisters subsequently dressed with mercurial ointment are
useful. In cases where considerable effusion has taken place, aspiratory punc-
ture is recommended by Jullien.

SYPHILIS OF THE BURSÆ.

Keyes, of New York,[1] designates as tertiary bursitis a late lesion which is
apt to follow after injury. The bursæ of the knee are most apt to be involved,
and the affection is very often double. The lesion is essentially a gummatous
proliferation in the thickened parietes of the serous sacs. The affection
begins insidiously, and is usually unaccompanied by pain, sometimes lasting
thus for months, when a blow or a fall brings on acute inflammation, the
lesion takes on new action, and extensive ulceration may take place.

The "mixed treatment" rapidly heals these lesions, without a scar if they are
of the superficial variety, but with a cicatrix if deep ulcerative action has
taken place.[2]

SYPHILIS OF THE NERVOUS SYSTEM.

The greater part of our knowledge of the syphilitic affections of the ner-
vous system is of recent date, and has been acquired within the last twenty
years. In 1859, the Academy of Medicine of Paris offered the subject of
"Nervous affections due to the syphilitic diathesis" for competition. In re-
sponse, three remarkable monographs,[3] which marked an epoch in the prog-
ress of this branch of medicine, made their appearance, and are still to be re-
ferred to with advantage on account of the valuable clinical material which
they contain. Ever since that time the medical press has been sending out
papers, monographs, volumes even, on nervous syphilis, in constantly in-
creasing numbers, until the literature of the subject has become extremely
voluminous.

It is obviously impossible, within the limits of the present article, to give
an extended account of the various lesions and symptoms of syphilis of the
nervous system. The utmost which can be accomplished is to give a general
idea of the subject, and to refer the student to original sources for further
information.

Syphilitic nervous affections may be developed as early as the sixth month,[4]

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[1] Syphilis as affecting the Bursæ (with a wood-cut). Am. Jour. Med. Sci., 1876.

[2] The following monographs and papers on syphilis of the bones, articulations, and bursæ,
may be referred to for further information. "Improved Forms of Artificial Noses" (Brit. Med. Jour.
1868); Sigmund, Zur örtlichen Behandlung syphilitschen Mund, Nasen und Rachen Affectionen
(Centralblatt, 1870, S. 653); Hutchinson, Syphilitic Caries of the Cranium with Abscess of the
Brain (Lancet, Dec. 14, 1872); Cuffer, Fracture presque spontanée du fémur droit consécutive à
un Ostéo-sarcome chez une Syphilitique (Bull. et Mém. de la Soc. Anat., Fév. 1874); "Dental Sy-
philis" (Lancet, vol. i. p. 674, 1876); R. W. Taylor, Bone Syphilis in Children, New York, 1876;
Richet, Mémoire sur les Tumeurs Blanches (Mém. de l'Acad. de Méd., t. xvii, 1853); R. W. Taylor,
Two Cases of Syphilitic Synovitis of the Knee (Am. Jour. Syph. and Derm., April, 1871); Verneuil,
Lésions Syphilitiques Tertiaires des Bourses Sous-cutanées et Tendineuses (Gaz. Hebd., 1873);
Moreau, Affections Syphilitiques des Bourses Séreuses (Thèse de Paris, 1870); Weil, Syphilitische
Gelenkrankheiten (Centralbl. f. Chir. 1877, S. 329); Wigglesworth, Cases of Dactylitis Syphilitica
(Am. Jour. Syph. and Derm., 1872, No. 21).

[3] Gros et Lancereaux, Des Affections Nerveuses Syphilitiques. Paris, 1861; Lagneau fils,
Maladies Syphilitiques du Système Nerveux. Paris, 1860; Zambaco, Des Affections Nerveuses
Syphilitiques. Paris, 1861.

[4] See Fournier, Leçons sur la Syphilis, 2e éd., for a full clinical description of the earliest
nervous disturbances of syphilis.

and as late as the twentieth year after infection. They are found more commonly among men than among women, and are apt to occur between the ages of twenty and thirty, chiefly because syphilis is most apt to be contracted at this period of life. It is said by some authorities that nervous symptoms are more apt to show themselves in cases where the earlier manifestations of syphilis have been mild, while others hold the opposite view, and consider severe early symptoms the forerunners of nervous disease. In my opinion, no prognosis can be made in any given case by observation of the early manifestations.

The nervous tissue is not usually attacked primarily, but as the result of lesions in the surrounding or investing structures. For instance, lesions of the meninges, or of the bones, induce softening or induration of the brain. A characteristic of the nervous lesions of syphilis is that they are peculiar in their distribution, and may occur in several places at once, thus giving rise to irregular and incongruous symptoms.

Nervous symptoms of a syphilitic character are peculiarly liable to occur in individuals of a neurotic or neuropathic constitution, hereditary or acquired. Mental anxiety, depressing emotions, sexual excesses, the abuse of alcohol and of narcotics, are among the known predisposing causes. Diseases accompanied by cerebral congestion, malaria and other conditions producing cachexia, may act indirectly. Sunstroke and injuries to the skull may also be included among the predisposing causes.

PATHOLOGICAL ANATOMY.—*Lesions of the Cranial Meninges.*—Meningitis may result primarily from syphilitic disease in the structure of the meninges, or secondarily from syphilitic lesions of the cranial bones. The first variety alone is at present to be considered. Either of the membranes may be affected singly, or all together. The lesions may be gummatous in character, or they may consist in diffuse infiltrations accompanied or not by inflammation, or inflammation alone may occur.

Lesions of the Encephalon.—Gummata of the brain present themselves in the form of irregular, variously-sized, firm tumors. These are almost invariably situated at or near the surface. Sometimes they occur in considerable numbers, and disseminated in different parts of the brain, thus giving rise, as has been remarked above, to various and confusing symptoms. As to size, gummata of the brain are rarely larger than a hen's egg, or smaller than a pea. Miliary gummata of the brain are rarely or never met with. The most common seats of gummata are the convex surfaces of the hemispheres in the frontal region, the base of the brain near the pituitary body, and the pons Varolii. The first of these localizations explains the frequency of aphasia in syphilitic brain affections, while the latter accounts for the coexistence of trifacial neuralgia and paralysis of the motor nerves of the eye, this last being an almost pathognomonic symptom of brain syphilis.

Gummata of the *cerebellum* are very rare. Only a few cases have been reported ; these presented symptoms of motor incoördination, etc.

Lesions of the Spinal Meninges and of the Cord.—Lesions of the spinal meninges are almost always secondary, and due to exostoses of the vertebral walls. They are very rare as primary lesions, although such cases have been reported by Wilks, Winge and Charcot, and Gombault. In some of these cases the cord was also involved, gummata being found in its substance.

Lesions of the Nerves.—As has been said, the nerves are not usually attacked primarily by syphilitic disease, their troubles generally arising from pressure and atrophy, which interfere with their functions. Tumors of the nerves proper have, however, been reported by Esmarch and Jespersen, Dixon, Portal, and Delafield. Petroff asserts that the sympathetic is attacked,

but corroborative evidence of this has not as yet been brought forward by other observers.

SYMPTOMATOLOGY.[1]—*Headache* is met with in about one-third of all cases of syphilitic brain disease. The pain is different from that experienced in early cephalic periostitis; it is deep-seated, and is felt to be so by the patient. In some cases it may last for several months without being at any time excessive; it is dull and heavy, and the patient is able to go about his ordinary occupations in spite of it. Occasionally, however, the sensation of pain is excessive; the older writers exhausted language in the attempt to express its intensity and character. Sometimes there is a sense of constriction, as if the head were being squeezed in a vise; sometimes it feels as if it were being hammered; at other times the patient feels as if a ball of fire were rolling about within his skull. Delirium, acute and even suicidal, and heavy stupor, physical and mental, are sometimes experienced. Nocturnal exacerbation is characteristic of this as of other syphilitic affections, the exceptions being rare.

Another characteristic is the long persistence of the pain where medication has not been employed. Cases have been reported in which the pain had persisted for ten and even twenty-five years, and it is not infrequent to see cases where the head-trouble has resisted the entire arsenal of anti-neuralgic remedies for months, to yield in twenty-four hours to anti-syphilitic medication.

The seat of this form of headache is, in seven cases out of ten, frontal or temporal; the posterior portions of the cranium are rarely affected. The pain is diffuse, and not local.

Absent, as has been said, in a considerable number of cases, headache is, when present, an early and a very important prodromic symptom—a call for immediate therapeutic aid to avert almost certainly appending disaster. Unfortunately, however, it is a symptom too often overlooked, ignored, or misunderstood.

Paralysis.—Sensation and motion may be abolished in any portion of the body by the action of the syphilitic poison, but one of the marked characteristics of affections of this nature is their partial and often incomplete character. They often succeed convulsive symptoms, aphasia or cephalalgia, and may occur at a very early stage in the syphilitic disease, showing themselves as paralyses of the cranial nerves.

Paralysis of Sensory Nerves.—Abolition of *olfaction* is sometimes observed; it is commonly, if not always, a sign of intra-cranial disease. The invasion of the affection is very slow and deliberate, and it yields readily to anti-syphilitic treatment. In many patients olfaction is only lost on one side.

Anosmia may be due to a lesion of the seventh or of the fifth pair. In case of paralysis of the facial, the muscles of the corresponding nostril become immobile, and present a mechanical obstacle to the perception of odors. When the nasal or superior maxillary nerves are affected, the mucous membrane of the nasal fossæ may suffer an impairment of nutrition, which may put an entire stop to the performance of the olfactory functions.

Abolition of the *sense of taste* has been reported.

Vision may be interfered with by lesions about the roots of the optic nerves.[2]

Clinically, the loss of vision, occurring suddenly or gradually, accompanied by subjective sensations (muscæ volitantes, blue or red sparks, or circles of

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[1] I have borrowed largely from Jullien in the present and previous parts of this section.

[2] For a detailed description of these syphilitic nervous eye affections, see Jullien, op. cit., p. 950.

fire), is often only partial. The patient can only distinguish a part of a single object, or of two objects sees but one. Another only sees the top and bottom of some object in front of him, the middle part remaining invisible. In some cases of amaurosis, the first effect of treatment is to make the blindness partial merely. A case is on record where the perception of one color after another was successively restored.

A singular and, as yet, inexplicable intermittence, regular or irregular, has been noted in some cases. In one instance, loss of vision occurred daily between twelve and two, preceded by a severe frontal headache. The attack usually lasted from a quarter to half an hour, and was repeated several times.

The prognosis of these eye-troubles depends upon their early recognition and treatment by means of iodide of potassium. When the tissues are secondarily involved (atrophied by pressure, etc.), it is too late to expect much advantage from treatment.

Hearing.—Various disturbances of audition may occur, due to neoplasms situated in the neighborhood of the auditory centres and of the eighth pair of nerves, either along their course or in their intra-bulbar portion. Very frequently the deafness of nervous syphilis is preceded by a period of excitation, characterized by auditory hyperæsthesia, or by the production of various subjective sensations. It is hardly necessary to say that this ear-trouble of central origin, characterized as it is by want of regularity, its occasional intermittence, and its curability, should be carefully distinguished from that variety of continuous deafness which is brought about by local syphilitic affections of the auditory apparatus.

Paralysis of the Motor Nerves of the Eye.—The three motor nerves of the eye, passing as they do for some distance along a bony canal, and in a portion of the cranium peculiarly subject to the late lesions of syphilis, are very apt to be affected by the pressure of some neoplasm, or some inflammatory swelling of the periosteum, at one point or another. In fact, a sudden and unexpected paralysis of these nerves may be said to be an almost sure sign of the existence of syphilitic disease, even when no other exists.

The *motor oculi*, the *motor externus*, and the *patheticus* may be weakened or paralyzed either singly or together, one or two branches on the right side being sometimes affected at the same time that other branches on the left side are similarly involved. Also, the degree to which the nerves are affected varies in different cases, and occasionally at different times in the same case, a circumstance which often makes the diagnosis quite difficult. In examining a case, careful analysis must be made of the muscles affected, and then, by referring to the nerves supplying these muscles and collating the facts observed, the lesion may often be located. These, like the other syphilitic affections, are very variable from one time to another, and also, it may be added, are usually very amenable to timely treatment by specific remedies.

Hemiplegia.—The hemiplegia of syphilis has been particularly studied by Van Buren and Keyes.[1] It is characterized by occurring at an earlier age than other forms of hemiplegia, eighty per cent. of the reported cases having occurred before the age of forty, while forty-six per cent. only of apoplectic hemiplegias occur before the same age. Another characteristic of syphilitic hemiplegia is the coincidence of fixed and persistent headache, which is an invariable symptom. Other diagnostic points are, the occurrence of the hemiplegia without loss of consciousness, and the concomitant existence of other syphilitic lesions, particularly dilatation of the pupil, showing either in the eye on the hemiplegic side or on the other, without paralysis of the motor oculi.

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[1] Syphilis of the Nervous System, N. Y. Med. Journ., Nov. 1870.

Paraplegia is a rare syphilitic nervous affection. It is usually brought about by direct or indirect lesions of the cord or its membranes. Sometimes it is due to a neoplasm involving the cerebral motor centres. Cases of acute myelitis with paraplegia occurring in syphilitic subjects, and supposed to be due to the syphilitic disease in its early period, have been reported by Mauriac and others.

Among the more prominent features of syphilitic paraplegia the following may be mentioned. Contrary to what occurs in hemiplegia, where vesical contractility is always intact, dysuria is often one of the earliest symptoms. The patient expels his urine with difficulty, and often fancies that he is suffering with urethral stricture. Imperfect erection with premature expulsion of the semen on attempting copulation is likewise common. The affection runs a rapid course, soon reaching its full development, and then remaining unchanged for a long time, sometimes indefinitely; it is rare, however, to observe complete palsy of the lower limbs; commonly there is nothing more than a difficulty of movement—paresis. Among the most important concomitant symptoms, from a diagnostic point of view, are headache and backache —rachialgia—very frequent and very significant signs of the syphilitic affection, above all when they occur or become aggravated at night.

Syphilitic paraplegia is by no means the mild affection it has sometimes been represented. Although mercury and iodide of potassium often have a marvellous influence upon it,[1] and indeed are the true criteria of diagnosis, they by no means invariably cure. The rule, indeed, is that the morbid tissue disappears only to leave behind it some indelible trace of its presence, and that the patient not only does not get completely well, but is subject to relapses, each more severe than the previous attack. Left to itself, the affection may give rise to serious complications; retention of urine may lead to incurable lesions of the bladder and kidneys, and the position which the patient is obliged to assume may in time give occasion to sloughing bedsores, with possible purulent infection.

Epilepsy, or rather the occurrence of epileptiform attacks, is among the commonest phenomena of syphilitic cerebral disease, a fact which is not surprising when it is remembered that the cortical portion of the brain, the favorite seat of syphilis, is at the same time the seat of the motor centres. The epileptiform attack may occur at the beginning of the cerebral disease, or it may occur during its course as an epiphenomenon of serious import, and one usually presaging fresh complications. At present, only epilepsy as it occurs by itself will be considered.

The utmost importance attaches to the diagnosis between syphilitic and non-syphilitic epilepsy, especially from a therapeutic point of view. The chief characteristics of the variety we have under consideration, are as follows: In the first place, there is nothing peculiarly distinctive with regard to the frequency of the attacks; they may occur daily or they may occur monthly, or they may occur several times in twenty-four hours. Occasionally they recur at certain hours. Night is a favorite time, as it is also for the attacks of common epilepsy. Various causes have been assigned as immediately provocative of the attacks, but these are so numerous and in many cases so trifling that I do not think that they can be seriously considered. With regard to the crisis itself, this is sometimes sudden, the patient dropping as if shot; more frequently, however, there is an aura, often consisting of an inexpressible discomfort at some point, rapidly becoming generalized over the entire body. *The "cry" of common epilepsy is rarely uttered*—an important diagnostic point.

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[1] Cases are given by Fournier and Buzzard where paralysis of all four limbs has been **entirely** cured.

Although the attacks of syphilitic epilepsy are usually precisely similar to those of ordinary epilepsy, yet certain differences in the character of the convulsions, or of the disturbances of ideation, exist at times, and may serve to aid in the diagnosis of doubtful cases. In the first place, the symptoms are less marked both as to generalization, duration, and intensity. The convulsions are only partial. Consciousness in many instances remains intact, or is scarcely affected, and, in a word, the syphilitic epileptic attack is only a feeble representation—a shadow, as it were—of ordinary epilepsy.

In the mildest form, a sudden flash of pain is experienced in one or more limbs, followed by torpor. A more marked phase of the disease is characterized by trembling. A curious group of symptoms, sometimes observed, includes spasm of certain muscles of the trunk and limbs. An individual may be suddenly seized, while walking in the street, with a violent spasm of the posterior muscles of the neck, the sensation being as if the head were being driven down between his shoulders. Now and then one or another of the contractile orifices of the alimentary or air passages is affected, and the patient is suddenly attacked by agonizing dyspnœa, pharyngo-laryngismus, or œsophagismus. Now and then involuntary emission of urine or feces occurs.

The convulsions of syphilitic epilepsy are irregular in appearance and character. One peculiarly characteristic variety is that in which the convulsions are confined to a single limb, generally one of the arms, or to the arm and leg of one side.

Consciousness is not always abolished, and the patient may, as Jullien says, be an anxious spectator of his own epileptic attack. Sometimes there appear to be two stages to the attack, the patient being conscious during the first and unconscious during the last. In some cases torpor lasting even from one to two hours may supervene on the attack. In these cases paralysis is threatened.

Subjective sensations of pain are occasionally observed. They may occur in one part or another of the body or limbs. In one case, severe pain in the testicle complicated the attacks.

Syphilitic epilepsy, unlike ordinary epilepsy, does not remain at a standstill. Left to itself, it may grow better through the relief of the causative lesion, as when a gumma of the cranium softens and opens exteriorly. Much more commonly, the attacks grow more and more frequent, and other nervous symptoms show themselves. This tendency to grow worse, and to result in disorders of intellection of one sort or another, is so characteristic of syphilitic epilepsy as to offer a diagnostic sign of the highest value. The danger of syphilitic epilepsy lies not so much in the epileptic attacks themselves, as in the permanent morbid conditions which so often supervene.

(1) There may be, in the first place, *disturbances of ideation*, the *petit mal* of the French, characterized by vertigo, momentary or brief "absence," ecstasy, and even temporary delirium, in which the patient may impulsively do himself or another some severe injury. The last-mentioned condition is important from a medico-legal point of view.

Independently of these symptoms, *gradual diminution and perversion of the intellectual faculties* may be observed. Benjamin Bell tells of a woman, twenty-six years of age, who was attacked by epilepsy after suffering severe headache. The attacks rapidly acquired extraordinary frequency and intensity (from four to six daily). Suddenly they ceased, and the patient became insane. She had been in this condition for two years when Bell, who had been called in to treat her for ulcers and cranial osteitis, administered mercury, and to his great astonishment saw the mental alienation entirely disappear in the course of a few weeks.

(2) In his statistics, based on the examination of 306 patients suffering with *haut mal*, without distinction as to their character, Echeverria[1] has noted the occurrence of paralysis in 68 instances—about 22 per cent. No doubt this proportion would be increased, if non-syphilitic epilepsies were excluded. Nothing is more frequent, in fact, than to see syphilitic epilepsy complicated by paralysis. At first the attacks leave the limbs weakened and enfeebled for a time. This period of enfeeblement becomes longer and longer, the symptom itself becoming more marked, until gradually complete paralysis steals on. Cases are known, however, in which paralysis has supervened at once after an attack. Paralysis of the motor nerves of the eye and of those of the face is very common in this form of nervous syphilis. Sensorial troubles, especially an involvement of the optic nerve, which can be recognized with the ophthalmoscope, are not uncommon as the result of syphilitic cerebral disease.

Aphasia.—Aphasia is one of those symptoms of syphilitic brain disease which has been studied carefully in the last few years, without, however, much light having been thrown on the obscure points connected with the production of the affection. Pathological investigation in connection with the occurrence of aphasia has shown that this almost always results from a lesion of the left third anterior convolution. The exceptions to the rule are few and obscure. The symptom itself may take on any one of the forms and modifications which are met with in common aphasia.

The prognosis of syphilitic aphasia is very variable. Coming on near the beginning of the brain trouble, and promptly placed under treatment, a nearly complete cure may be looked for; some days of treatment by iodide of potassium work wonderful changes in the symptoms. Relapses of increasing severity are, however, apt to occur. Aphasia unaccompanied by hemiplegia implies a less unfavorable prognosis than in the contrary case. Discontinuity of symptoms is a favorable sign. When these begin to assume regularity and continuity, the patient is growing worse.

Anæmic, Congestive and Apoplectiform Symptoms; Coma.—Cerebral gummata are frequently the centre and origin of more or less localized congestion. They may also give rise to anæmia by compressing an important vessel directly, or by augmenting the intra-cranial pressure generally, and thus closing some of the smaller vessels. Exudation may likewise take place as the result of pressure. It is of course impossible to separate these various conditions, and to decide which in any given case is the cause of the symptoms observed.

The earlier symptoms, which come on gradually, are those observed in ordinary cerebral disturbances of a similar character—transitory affections of the sensory organs, flashes of light, ringing in the ears, and decrease in tactile sensibility. At a later stage intellectual enfeeblement follows.

At a more advanced period, the sensory troubles may be transformed into hallucinations. One of Fournier's patients saw those about him standing on their heads, and the lamp-posts danced around him as he walked the streets. There is difficulty in coördination and loss of muscular sense, so that the patient cannot walk over a polished floor or descend a staircase without unusual precaution and anxiety, the symptoms being, in fact, similar to those of ataxy.

These symptoms too often presage a more severe affection, *apoplexy*, which is very apt to supervene sooner or later.[2] Maurice Mercier (see Ganul's

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[1] On Epilepsy. New York, 1870.
[2] See the valuable thesis of L. P. Ganul, Les Tumeurs Gommeuses du Cerveau, Paris, 1875, containing facts not elsewhere recorded.

Thesis) was the first to draw attention to syphilitic apoplexy, an affection which it is of the highest practical importance to recognize, because it is in many cases curable if taken in time. The following characteristic points may be noted: 1. The affection may occur in young persons. 2. The stroke occurs suddenly, while the patient is in perfect health, without the slightest prodrome such as is commonly observed in severe brain affections. 3. The following symptoms are observed during the attack: complete coma, the eyes closed, the limbs relaxed, not paralyzed, sensibility to marked excitation, persistence of the reflexes, audition unaffected; the patient hears, but cannot reply, or, when pressed, replies feebly by a sign, showing torpor rather than abolition of intelligence; usually vision is interfered with by atrophy of the papillæ, the lesions being unequally developed on the different sides; the irides dilated to the maximum, the upper lids remain closed; there is sometimes strabismus; respiration calm, but stertorous, pulse regular, no fever, paralysis of the sphincters with involuntary defecation and urination, the urine normal, and giving no sign of uræmia. Finally, epileptiform convulsions and vomiting rarely occur.

Special attention should be paid to the presence or absence of these symptoms in all questionable cases. There is no doubt that numbers of patients succumb to what are supposed to be apoplectic seizures, but which are in reality the results of syphilis. A careful examination, with the diagnostic and characteristic features of the disease, as above given, in mind, will in some cases lead to active therapeutic interference with beneficial result.

Intellectual Disturbances.—Owing, as has been said, in speaking of syphilitic epilepsy, to the fact that syphilitic lesions are apt to be situated on the periphery of the brain mass, intellectual disturbances in the later phases of syphilis are among the commoner nervous affections. Sometimes they occur alone, but more frequently in connection with other nervous manifestations, the fact being that the various symptoms rarely occur separately or in regular order, but are more frequently jumbled together.[1] Among the symptoms of a *depressive* character may be mentioned loss of memory. This is rarely complete, and is extremely variable in its nature and in its progress, sometimes being slowly progressive, and at other times occurring suddenly and completely, or in successive attacks. It is apt to be associated with other nervous disorders, such as epilepsy, etc., which may make the diagnosis less difficult. Symptoms of *exaltation* and *perversion*, amounting to true mania, are among the symptoms of cerebral syphilis.

Is there such an affection as *general paralysis*, like the well-known general paralysis of the insane, due to syphilitic cerebral disease? This question has not yet been decided. It is not enough I think to obtain a history of syphilis, or what passes for such; the connection between cause and effect must be drawn closer, and in addition there should be some cases at least in which antisyphilitic treatment has proved beneficial in the early stages.

Visceral Disturbances due to Nervous Lesions.—As visceral sensations are commonly located in the occipital lobes, it might be supposed *a priori* that syphilitic lesions in these locations would be followed by visceral symptoms, and such indeed is the case. *Boulimia, polydipsia, vomiting, polyuria,* and even *diabetes* have been shown to be dependent upon syphilitic lesions of the nerve centres.[2] Diminution of the frequency of *cardiac action*, syncope,

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[1] For a more detailed description of the intellectual disturbances of syphilis, see F. Dreer, La Sifil. e la Pazzia, Archivio Ital. per le Mal. Nervose, etc., 1869, and Manssurow, Die tertiär syph. Gehirnleidern Geisteskrankheiten. Wien, 1877.
[2] See the very interesting case of Perroud, Ann. de Derm. et de Syph., t. i., p. 519.

slowing or acceleration of the *respiratory movements*, cough, dyspnœa, etc., have been mentioned as possible results of cerebral nervous disturbance in syphilis, but I do not know of any accurate observations bearing on this subject.

Incoördination of Movement; Ataxy.—A case is recorded by Ganul (op. cit.) where incoördination without muscular weakness occurred in a patient. At the autopsy, an almond-sized gumma was found in the cerebellum. Leven and Neumann have observed vertigo, vomiting, and strabismus in association with incoördination.[1]

The question has been discussed of late years, whether syphilis can give rise to locomotor ataxia. The lesion usually associated with the symptoms of locomotor ataxia, is, as is known, diffuse sclerosis of the posterior columns of the spinal cord, a lesion so different from those usually produced by the influence of syphilis upon the nervous system, as to prejudice the mind against the possibility of syphilis causing this group of symptoms. No pathological evidence of the existence of syphilitic locomotor ataxia has been brought forward; but, on the other hand, the indirect clinical evidence in its favor is of the strongest. The question must for the present be considered *sub judice*.[2]

PROGNOSIS AND TREATMENT OF NERVOUS SYPHILIS.—The gravity of the prognosis of syphilis depends upon the period at which appropriate treatment is instituted, and upon the amount and degree of secondary involvement of the affected tissues. "Against the syphiloma itself," says Jullien, "we are all powerful; against the secondary resultant lesions we are disarmed." Taken all in all, however, the prospects of success are discouraging. Not only is it difficult or impossible in many cases to procure any amelioration, but even when an apparent cure has been effected, successive relapses disappoint both the practitioner and his patient. Add to this that in some cases the cicatrization of the syphiloma itself brings about permanent injury, and the prospect of success seems gloomy. On the other hand, in successful cases the result is often little less than brilliant. (See Van Buren and Keyes, op. cit.) As to the treatment, iodide of potassium is the best remedy. It should be used freely, often in heroic doses: as much as an ounce three times a day has been given by Broadbent. However, in some cases mercury succeeds when the iodide fails, and these remedies should be tried alternately and together when necessary. Of course the ordinary remedies employed in the various neuroses—revulsives, bromides, electricity, hydrotherapy, and hygienic measures—should be used in addition to the more purely specific remedies.[3]

[1] Leven, Tumeur Syph. du Cervelet. Gaz. des Hôp., 1864.

[2] See Fournier, De l'Ataxie Locomotrice d'origine Syphilitique. Paris, 1876; A. Reumont, Syphilis and Tabes Dorsalis. Aachen, 1881; also Proceedings of the Int. Med. Congress, London, 1881; and an editorial in the Medical Times and Gazette, Nov. 19, 1881.

[3] In addition to the references given in the text, the following monographs and papers on special subjects connected with syphilitic nervous disease may be referred to. Further information of this kind may also be gained from Jullien and Lancereaux.

Hubner, Syphilis of the Brain and Nervous System. Ziemssen's Cyclopædia, Am. ed., vol. xii.

Dowse, The Brain and its Diseases; vol. i., Syphilis of the Brain. London, 1879.

Keyes, Syphilis of the Nervous System. N. Y. Med. Jour. Nov. 1870.

Jaksch, Syphilitic Paralysis. Präg. med. Wochen., 1864, Bd. xxii. Nos. 3 und 4.

Little, Syphilitic Tumor of the Dura Mater. Dublin Quart. Jour., vol. xlvii. 1868, p. 222.

Chevalet, Paral. Asc. d'origine Syphilitique, guérie par les frictions. Bull. de Thérap., 1869.

Echeverria, G., Epilepsy. New York, 1870.

Tarnowsky, B., Aphasie Syph. Paris, 1870.

Gay (of Kasan), Statistics of Cerebral Syphilis. Arch. f. Dermatol. u. Syph., 1870.

Moxon, Syphilitic Disease of the Spinal Cord. Dub. Quart. Jour., vol. li. 1870, p. 449.

De Méric, Syphilitic Disease of the Third Nerve with Mydriasis, without Ptosis. British Med. Jour. vol. i. 1870, p. 29, 52.

H. Mollière, Myélite Syphilitique Aiguë. Ann. de Derm. et de Syph., t. ii. 1871, p. 311.

Hereditary Syphilis.

ETIOLOGY.—Regarding the manner in which syphilis is transmitted from parent to offspring, there is as yet no agreement among syphilologists. Whether a syphilitic father can impress his disease upon the fecundating germ, so that the resulting fœtus shall be syphilitic without the intervention of the impregnated female, or whether syphilis can only pass to the fœtus through the mother, are questions upon which the best authorities differ widely. Numerous cases tending to prove one view or the other, and going to show on the one hand that syphilis can come only from the mother, or, on the other hand, that it may proceed from the father alone, have been reported, but the majority of these reports are lacking in convincingly precise details, and many are ludicrously wanting in care and accuracy. To some so-called " observers" no case can be so destitute of well-ascertained data as to be unserviceable in proving the preconceived theory.

A careful examination of the cases thus far reported by trustworthy observers, and a comparison of these with my own personal experience, incline me to the belief that, while in the majority of cases of hereditary syphilis the mother has been syphilitic, yet that a certain number of carefully observed cases, reported by some among our ablest living clinicians, go to indicate that a syphilitic father may procreate syphilitic children, the mother remaining to all appearance, and in all likelihood, perfectly healthy.

The chief champion of the paternal influence in this county is Dr. R. W. Taylor, but although most of our syphilographers, as far as they have expressed themselves in print, are inclined to take this view of the subject, there are not wanting others, prominent among whom is Dr. F. R. Sturgis, who stoutly deny the possibility of syphilis being transmitted to the ovum in utero by the semen of the male parent, without the mother being infected either by the husband or by the ovum.

D. Mollière, Cas d'Anosmie Syph. Ann. de Derm. et de Syph., t. iii. 1871, p. 74.

Lunggren, Syphilis of Brain and Nerves. Archiv für Derm. u. Syph., 1872.

Owen Rees, Cerebral Syphilis. Guy's Hosp. Reports, 1872, p. 249.

Cross, T. M. B., Clinical Observations upon Syphilitic Diseases of the Nervous System. Am. Jour. Syph. and Derm., vol. iii. 1872, p. 216.

Petroff, Ueber die Veränderungen des sympathischen Nervensystems bei const. Syph. Virchow's Archiv, lvii.; Cbl. f. Med. 1873, p. 510.

Charcot and Gombault, Syphilis des Centres Nerveux. Arch. de Physiol., 1873.

Hughlings Jackson, Syphilis of the Nervous Centres. Med. Times and Gaz., 1873.

Delafield, Syphilitic Tumors of the Spinal Nerves. Am. Jour. Syphilog. and Dermatol., vol. iv. 1873, p. 26.

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Mauriac, Mémoire sur les Affect. Syph. précoces des Centres Nerveux. Ann. de Derm. et de Syph. t. vi. 1875, p. 161.

Mauriac, Leçons sur l'Aphasie, et De l'Hémiplégie Droite Syph. à forme interne. Gaz. Hebdom., 1876.

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G. Homolle, Méningo-myélite Subaiguë à la fin de la période séc. de la Syph. Mém. et Bull. de la Soc. Anat., p. 514, 1876.

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Fournier, Paral. du Mentonnier, par lésion syph. du Maxillaire Supérieur. Gaz. des Hôp. No. 34, 1877, p. 271.

R. H. Alison, Some Cases of Syphilitic Chorea. Am. Jour. Med. Sci., vol. lxxiv. 1877, p. 75.

Fournier, Syphilis du Cerveau. Paris, 1879.

Reumont, Syphilis and Tabes Dorsalis. Aachen, 1881.

R. W. Taylor, Clinical Notes on Neuralgia of the Sciatic Nerve, caused by Syphilis. New York Med. Jour., March, 1880.

Reuben A. Vance, Syphilitic Epilepsy. Am. Jour. Syph. and Derm., vol. ii. 1871, p. 208.

The two following cases, which I select as illustrating the difficulties of the subject, show the strongly convincing facts which may be brought forward for either view :—

Mireur[1] gives the following striking illustration of syphilis in the father failing transmission in procreation, only to be conveyed to his child by direct contact after birth. M. C. suffered with chancre and generalized symptoms, for which he was treated, and was apparently cured. About ten or eleven months after the chancre he married. His wife at once became pregnant, and gave birth to a healthy child who remained well up to the age of two years. Meantime M. C. had now and then some " vague souvenirs" of his former disease, and at the end of this period showed a slight erosion on his lower lip. As he thought nothing of this indolent lesion, he continued to fondle and kiss his child as usual. A short time after, however, the child showed a well-marked labial chancre, followed by generalized symptoms.

Taylor,[2] on the other hand, gives this equally convincing illustration of the exclusive paternal transmission of syphilis : A woman to all appearance healthy, under the careful scrutiny and observation of Dr. Taylor himself, but whose husband was and continued to be the subject of syphilitic disease, gave birth to four syphilitic children in succession. Then, her husband coming under treatment, she gave birth to a healthy child. Afterwards, the husband having neglected treatment meanwhile, and having suffered a relapse of his syphilitic disease, the wife gave birth to a syphilitic child. Finally, a year or two subsequently, the husband having once more submitted to a thorough course of treatment, the wife gave birth to a healthy child. The wife remained without treatment, excepting the use of quinine and iron, through the whole period of this history, and at no time showed any signs of syphilitic disease.

A few cases have been reported going to show that even when both parents present the evidences of syphilitic disease, the infant may be free from syphilis ; but these observations must be regarded as doubtful, excepting where the parents have both been under treatment at the time of conception, and the mother subsequently, or where the disease is of long standing, only manifesting itself in sluggish local affections.

A certain immunity to the child exists in late syphilis of the mother. I have at present under observation a woman in her twelfth year of syphilis, who conceived while suffering from a gummatous ulcer of the arm, for which irregular and insufficient treatment was pursued, with intervals of no treatment, a month or more in duration. This woman gave birth to a child which now, sixteen months old, has *as yet* shown no sign of syphilitic disease, but is fat and flourishing. The mother's lesion is gradually healing under more regular treatment pursued of late.

As regards the influence of father and mother after conception, that of the former may be dismissed as *nil*. The so-called cases of infection of the fœtus by syphilitic semen are now known to be incorrectly reported, since repeated experiments have shown that semen cannot convey the syphilitic virus.

It is otherwise with the mother. If she has conceived a healthy child by a healthy father, and is subsequently contaminated, the fœtus will suffer. How long and to what period this susceptibility of the fœtus to the syphilis of the mother exists, cannot be accurately stated. Most observers agree in admitting that if the mother is infected with syphilis before the seventh month of pregnancy, the fœtus can hardly escape. After that date, it is uncertain whether or no the maternal influence can be reckoned as giving rise to syphilis in the infant. Most of the cases of later infection lack the essential data to be convincing.

The idea formerly entertained that the child could contract syphilis during birth from chancre, mucous patches, etc., upon the external genitals of the mother, has been dispelled by the result of practical observation, which shows

[1] Essai sur l'Hérédité de la Syphilis. Paris, 1867.
[2] A Contribution to the Study of the Transmission of Syphilis. Archives of Clinical Surgery, Sept. 1876

simply that such is not the case. No instance has ever, to my knowledge, been reported where an infant has displayed a chancre derived from contagion during the process of birth.

In connection with the etiology of hereditary syphilis, "Colles's law" may be mentioned. It is well known that a diseased child almost invariably infects a healthy wet-nurse who suckles it, but the infection of a mother by suckling her own diseased child is as yet unknown. This fact was first noticed by Abraham Colles, of Dublin, in 1837. It has been called by Mr. Jonathan Hutchinson "Colles's Law."

The doctrine of *choc en retour*, or the transmission of syphilis from the fœtus to the mother, was taught by Ricord, and has been more recently maintained by Hutchinson and Dickinson, who assert that a man may beget an infected child which may convey the syphilitic virus to the mother. The chief ground for the acceptance of this view is found in the fact that mothers having produced syphilitic children, themselves develop specific symptoms during or soon after pregnancy. I think that, although there is nothing improbable about this theory, no conclusive evidence has as yet been brought forward to sustain it.

PATHOLOGY. *Syphilis of the Placenta.*—The syphilitic lesions of the placenta are as yet only imperfectly understood. According as it is circumscribed or not, syphiloma gives rise to gummatous placental endometritis, or to diffuse interstitial placentitis. Commonly both forms are associated. In the circumscribed form, the lesions often present the appearance of papular or condylomatous neoplasms, implanted in the free portion of the decidua, and formed of a very vascular mucous tissue. Sometimes they resemble hard tumors, and penetrate the tissue of the placental cotyledons like wedges. The fatty degeneration which results in these gummatous deposits makes it easy to confound them with tuberculous masses. The absence of vessels, the presence of refractive granulations, like those observed in syphilis of the liver, together with the sclerosis and concomitant external symptoms, will settle the diagnosis.

SYMPTOMATOLOGY OF HEREDITARY SYPHILIS.

DATE OF APPEARANCE OF THE LESIONS.—The only certain way of ascertaining the appearance of the earliest symptoms of hereditary syphilis is to watch for skin eruptions. Earlier visceral lesions there may be, but of these we can take no certain cognizance during life.

The statistics of Diday and Roger, comprising 172 cases, show the following various dates after birth of the appearance of hereditary syphilitic symptoms :—

Before the end of the first month in	.	.	.	.	.	92 cases.
" " third "	.	.	.	.	.	67 "
" " fourth "	.	.	.	.	.	7 "
" " fifth "	.		.	.	.	1 case.
" " sixth "	.	.	.	.	.	1 "
After the sixth month .	.	.	.	.	.	.	4 cases.

It is thus seen that in the great majority of cases hereditary syphilis shows itself before the end of the third month. A few cases have been reported where the appearance of the symptoms has not occurred until the fifteenth month, and Diday gives one case where the visible outbreak was delayed until the end of the second year; but these cases are very exceptional.

Of late years our knowledge of the subject of hereditary syphilis has been much enlarged, and various affections occurring in late infancy and in childhood, formerly unclassified, are now included under this head. In some reported cases, it appears that these late lesions have not been preceded by any earlier symptoms, but the difficulty in obtaining facts in regard to such points can easily be understood. It is certain, however, that in many of these cases good results have been obtained by antisyphilitic treatment.

The mortality of syphilitic children is very great, fully one-third failing to reach maturity. Abortion resulting from the death of the foetus usually occurs about the sixth month, while that caused by infection of the mother during pregnancy takes place somewhat later. An aborted foetus is usually in a macerated condition, the skin being easily detached, and the surface having a livid, purple color, while various lesions will be found in some of the viscera. The integument may show nothing characteristic, or large bullæ may be found on the soles and palms.[1] (Bumstead and Taylor.)

Syphilitic children generally present a healthy appearance at birth, and for a week or two all seems to go well. Then symptoms of debility and decreased vitality show themselves, the infant begins to emaciate, and grows wizened and aged in appearance. Catarrh of the nasal passages—" the snuffles "—shows itself, interfering with respiration, and thus sometimes itself alone being the cause of death. The skin becomes yellow, loose, and wrinkled. It is drawn tight over the bones of the face, which becomes sallow and earthy, with prominent eyes and a peculiar senile expression, the infant presenting the appearance of decrepit old age. Usually the symptoms of failure of nutrition, and of disease, occur at an earlier date if the affection is severe. Now and then, however, excessive emaciation is not observed even when the syphilitic poison has affected the system to a marked degree, just as we see adults who go through a course of syphilis in its various manifestations without appearing to suffer thereby in general health.

SKIN MANIFESTATIONS IN HEREDITARY SYPHILIS.—The syphilitic eruptions of infants are in all respects the same as those of adults, excepting in so far as their appearance is altered by the peculiarities of structure of the infantile integument.

The erythematous syphiloderm is that which is earliest and most frequently observed. It generally makes its appearance about the third week of life, often accompanied by coryza, and showing itself first on the abdomen in the form of minute, round or oval, pink macules. It spreads rapidly over the surface of the body and limbs, and the patches grow larger and darker, until they may be half an inch in diameter, slightly or not at all elevated above the surface, coppery red in color, and no longer, as at first, disappearing under pressure. There is usually little or no scaliness, excepting upon the hands and feet, where slight desquamation may be present, especially if the eruption is well marked.

This eruption is very liable to be confounded with the simple erythematous rashes of early infancy. The most important diagnostic points are the tendency to infiltration, and the formation of papules in places where the skin comes together in folds, as about the neck, and also especially in the region of the genitalia and nates.[2] In addition, the tendency to scaliness about the palms, soles, and occasionally the nates, is more or less characteristic. Occasionally this eruption is extremely difficult to distinguish from erythe-

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[1] See Plate XIV. Fig. 2.

[2] Plate XIV. Fig. 1 gives a fair representation of this form of eruption running into the papular variety.

matous eczema; and I have in several instances met with cases where a diagnosis was at first impossible, and was only arrived at after holding the patient for some time under observation, the simplest local remedies being used, and the development of the case being carefully watched. Of course the syphilitic eruption, were it such, would be apt to go on from bad to worse, and to be accompanied by other symptoms, while the eczematous eruption would either get well under the simple local treatment, or would develop some characteristic signs, such as weeping, papulation, vesication, etc.

The papular syphiloderm is not unfrequently met with in connection with the erythematous form of the disease. It is sometimes the first eruption to be observed. The lesions are large and small, flat papules, with a dull-red, afterwards a coppery, color, and a smooth surface. Occasionally they may exfoliate to some extent, especially upon the palms. Sometimes a number of papules fuse together, and form a patch of a dull-red color, much thickened and occasionally scaly. Such patches may occur, covering the entire foot or hand, or a portion of the thigh (as in Plate XIV. Fig. 1).

When they are seated about the anus or genitalia, the heat and moisture of the parts, with the frequent maceration in urine and fecal discharges to which infants are subject, conduce to the formation of mucous papules. These skin lesions, which are among the commonest of hereditary infantile syphilis, are quite characteristic. At times they tend to condylomatous outgrowth, and may resemble the simple acuminate condylomata of infants from which they are to be carefully differentiated.

The chief distinctive feature of syphilitic condylomata in infants is that the acuminate excrescence springs from a previously existing papule, similar ones usually being visible in the immediate neighborhood. There is also usually a certain amount of extremely fetid discharge of a characteristic odor, in syphilitic condyloma acuminatum, while in the simple condyloma this is not so marked a feature. When the papules are situated about the mouth or at the commissure of the lips, they are usually moist, and in this position are the most frequent carriers of contagion to the nurse, in nursing, and to other children, or adults, in kissing. It is hardly necessary to say that the moist papule in the infant, as in the adult, is one of the most frequent mediums by which syphilis is propagated. The abominable habit, prevalent in this country and perhaps in others, of submitting infants to the caresses of every chance comer, is responsible for many cases of mysteriously contracted disease; and it seems to me a part of the duty of the family physician to warn mothers of the dangers thus incurred.

When the papule occurs in the commissure of the lips, it leaves in healing slight linear or radiating scars, which may subsequently aid in the diagnosis of previously existent syphilis.[1]

The vesicular syphiloderm is a very rare affection, sometimes resembling vesicular eczema to a certain degree. It generally occurs in connection with other lesions, pustular, bullar, etc. The vesicles are usually distinct, seated upon firm infiltrated or papular bases, and show no inclination to coalesce, though they sometimes tend to involve the deeper layers of the skin.

The pustular syphiloderm may occur before the eighth week, in children profoundly affected with syphilis, but usually shows itself at a later period. According to the severity or mildness of the disease, the pustules are large, numerous, and deep; or small, few, and superficial. The lesions are commonly most abundantly met with on the thighs, buttocks, and face, although

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[1] I regard this as a more certain testimony of previously existing syphilitic disease than the so-called "Hutchinson's teeth," to be presently described, because it is not likely to be confounded with any other cicatrix. I do not know of any affection capable of leaving such traces.

PLATE XIV.

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1.

Infantile syphilis.

they may occur in any part of the body. About the face they often tend to group, and to form crusted patches resembling at first sight the lesions of contagious impetigo, or of impetiginous eczema. From the latter, however, they are to be distinguished by not itching, by the thickness and greenish-brown color of the crusts, those of impetiginous eczema and impetigo being thinner and lighter yellowish-brown, like honey. The eroded surface underneath the crusts tends in eczema to heal over, and always without a scar, whereas the syphilitic erosion is more inclined to be ulcerative. The base of the lesions in syphilis is thickened, and they are surrounded by a violaceous red areola. Syphilitic acneiform lesions are sometimes met with on the scalp, in infants, while ecthymatiform pustules are encountered about the limbs in severe cases. These last are apt to result in loss of tissue.

The Furunculoid Syphiloderm.—Bumstead and Taylor describe a furuncle-like eruption which may occur as early as the sixth month, or as late as the third year of hereditary syphilis. The lesions may occur alone, constituting the only symptom of the disease, or they may be accompanied by other eruptions. Their number varies greatly in different cases. They begin as small nodules in the corium, and gradually increase to the size of half a nutmeg, ulcers form on the summit, sloughs are thrown off, and irregular, unhealthy cavities with scanty effusive secretion are left, the lesions subsequently running a chronic course. They often result in cicatrices.

The tubercular syphiloderm is a rather rare manifestation of hereditary syphilis. It may occur as early as the sixth month, or as a recurrent affection at two or three years. The tubercles begin as deeply seated papules or nodules; the skin is involved afterwards, and finally ulcers of greater or less size result, with abundant secretion, and often covered with crusts. Occasionally vegetations may spring up from the surface of the ulcer as in the following case reported by me several years ago.[1]

An infant of eight months with a well made out syphilitic history showed progressive emaciation, snuffles, and an eruption, situated chiefly upon the face, though observable elsewhere. The lesions when recent consisted of discrete, indolent, tubercular elevations, of pin-head to pea size, roundish, well-defined, firm, and elevated. Older lesions were seen to have coalesced into elevated coin-sized patches, with here and there pustular points, coalescing in places into ulcerated patches covered with brownish laminated crusts. One of these, larger than the others and situated on the cheek, showed a rough, uneven, warty, mammillated surface, covered with a crust. On poulticing this, a shining red surface, covered with vegetations, could be observed. The abundant secretion was horribly fetid. The eruption closely resembled a patch of impetiginous eczema, but the infiltration of the skin, the mammillated surface, the abundance and fetid character of the discharge, and the thick, opaque, brownish crusts, served to make the diagnosis plain even without considering the characteristic lesions elsewhere.

The tubercular syphiloderm is to be differentiated from the scrofulodermata of the skin sometimes found in infants and young children. The lesions resemble one another closely, and a careful investigation of the history of the case, with a close examination of the lesions in the light of the description given under the head of syphilodermata in adults, will be required to make the diagnosis. *Gummata* of the skin are not very unusual among children affected with hereditary syphilis. They are usually among the later lesions to show themselves, and sometimes a single lesion alone exists to mark the presence of the disease. They resemble in all respects the gummata found in adults.

Bullar Eruptions.—The bullar eruptions of new-born children ("pemphigus

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[1] A case of Vegetating Tubercular Syphiloderm in an Infant. Archives of Dermatology, vol. iii. 1877, p. 211.

neonatorum") have given rise to much discussion, and it was at one time considered that all such eruptions were of a syphilitic character. A true pemphigus neonatorum is now admitted, although this is a very rare disease.[1] It commonly occurs at a later date than the syphilitic bullar eruptions. The latter are most usually found upon the palms and soles (see Plate XIV. Fig. 2). The skin shows patches of a violet color; in a short time small confluent vesicles make their appearance upon these spots, and then coalesce and grow larger until the fully formed bullæ show themselves, varying in size from that of a pea to that of a hen's egg, with a yellowish-green, opalescent color, and purulent contents. Occasionally the lesions are brownish or even hemorrhagic. The areolæ are large, dark, and violaceous. Within twenty-four or thirty-six hours the bullæ break or dry up, leaving whitish crusts covering shallow ulcers. The eruption is of grave import, and rapid cachexia with general enfeeblement leads rapidly to a fatal termination. The bullar syphiloderm is to be differentiated from the pemphigoid eruption by its earlier appearance, by its usually more serious character, and by the concomitant symptoms and history. Sometimes impetigo contagiosa of young infants is mistaken for the bullar syphiloderm, but this eruption is of trifling import, its early appearance is different, and the crust when removed shows only a slight erosion. Moreover, the places of election of impetigo contagiosa are the face and mouth, the backs of the fingers and hands, and less frequently the wrists; the feet usually escape.

AFFECTIONS OF THE MUCOUS MEMBRANES.—One of the earliest symptoms of hereditary syphilis commonly observed is coryza or "snuffles," due to structural changes in the mucous membrane of the nasal passages, at first of an erythematous, and later of an ulcerative character. This may be slight, or it may be so severe as to interfere with respiration, particularly during sleep and nursing. At first serous, the discharge soon becomes purulent, and sometimes bloody and very offensive, excoriates the angles of the nasal opening, becomes inspissated, and plugs up the nasal passages. Sometimes the disease penetrates to the bony structures, and produces necrosis.

Mucous patches of the mouth in infantile hereditary syphilis do not present the typical opaline appearance seen in the adult. The lesions tend to coalesce and ulcerate, and, when occurring at the angles of the mouth in connection with moist papules of the outer surface, deep fissures sometimes supervene.

The serous secretion of mucous patches is highly contagious, and their early recognition is a matter of the utmost moment in order to prevent the risk of contamination. The infant must not be permitted to nurse at any breast but that of its mother, and must be placed in a rigid quarantine; all kissing and fondling, the use of utensils employed by others, etc., must be guarded against. The infection of the nurse by a child having mucous patches of the mouth is particularly liable to occur in hospitals, lying-in asylums, and the like.[2]

The mucous patches of hereditary syphilis are to be distinguished from the lesions of simple stomatitis, by the fact that in the latter the inflammation is generally more diffuse, the whole tongue in particular being intensely affected, and often covered with vesicles, which are not seen in the syphilitic affection. The tendency to the development of mucous patches at the corner

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[1] A very good description of the various non-syphilitic bullar eruptions of the skin in infants, generally classed as pemphigus, will be found in an article by Gustav Behrend, of Berlin. Beitrag zur Lehre von Pemphigus. Vierteljahrsschr. f. Derm. u. Syph. Jahrg. vi. 1869, S. 191.

[2] See an important paper by Dr. R. W. Taylor, The Dangers of the Transmission of Syphilis between Nursing Children and Nurses in Infant Asylums and in Private Practice. (Am. Jour. Obstet., Nov 1878.) Also Fournier, Nourrices et Nourrissons Syphilitiques. Paris, 1878.

of the mouth is also a valuable diagnostic sign. In stomatitis, the gums and the sulci between these and the cheeks are often the seat of the lesions, while those of syphilis are not found in that locality. Of course the history of the case and the concomitant symptoms must be taken into consideration.

Gummata of the mucous membranes are occasionally met with, but not in the earlier periods of hereditary syphilis. The features which these present in the infant are not different from those described as occurring in acquired syphilis of the adult. They are liable to be mistaken for strumous ulceration, but the history and general character of the lesion—being irregular, less sharply defined, and spreading more rapidly—will aid in the diagnosis.

AFFECTIONS OF THE VISCERA IN HEREDITARY SYPHILIS.—As in the acquired syphilis of the adult, so also in hereditary syphilis, the disease spares no organ or viscus. Our space, however, does not permit the discussion of the various affections in detail, and the lesions of the bones and the nervous system alone will therefore be described.

AFFECTIONS OF THE BONES.[1]—These are described by Bumstead and Taylor under the heads of *osteo-chondritis, periostitis,* and *dactylitis syphilitica.* The former is the most common osseous affection, and frequently its presence decides the syphilitic nature of coexisting lesions. The bones most commonly attacked are those of the forearm, the leg, the arm, and the thigh. The clavicle, sternum, and ribs are also attacked, as well as the metatarsal and metacarpal bones. In these cases of osteo-chondritis, a swelling, often imperceptible in fat children, is observed at the diaphyso-epiphyseal junction. There is a ring or collar around the bone at this point, or in some cases a less distinctly defined swelling. When two contiguous bones are affected, they often seem to be fused together.

The swellings may be developed slowly or rapidly; they are commonly indolent, and do not interfere with the movements of the joints, although these may become secondarily involved. The lesion may break down, soften, and ulcerate, the ends of the fragments of bone protruding through the opening. Separation of the epiphysis from the diaphysis is not uncommon. When resolution occurs, if the diseased action has progressed to any considerable extent, the cartilage having been destroyed, shortening of the bone takes place. Sometimes, however, the bone appears to be restored in its integrity. A curious condition of pseudo-paralysis of the involved limb often occurs in connection with this affection.[2]

Periostitis is a later affection, attacking the bones of children who have already begun to walk. The femur and tibia are first attacked, the greater part of the shaft being often involved, with general thickening and bowing anteriorly, producing marked deformity. The fibula is sometimes attacked, and both legs are apt to be affected. Occurring later in life the affection is more apt to be unilateral. Sometimes the bones of the skull are attacked, and the nodes occasionally break down and form troublesome abscesses. Periostitis usually occurs before the twelfth year, but may, in exceptional cases, be seen at a later period.[3]

[1] Our knowledge of these lesions is comparatively recent, and derived from the labors of Wegner, Ueber hered. Knochensyphilis bei jungen Kindern (Arch. f. path. Anat. Bd. 1. 1870); Waldeyer und Kobner, Beitr. z. Kenntniss der hered. Knochensyphilis (Arch. f. path. Anat. Bd. lv., 1872); Parrot (Arch. de Physiol. Norm. et Path. 4me Ann., 1872); and R. W. Taylor, Syphilitic Lesions of the Osseous System in Infants and Young Children. New York, 1875.
[2] I recently reported an interesting case of this affection, in which the pseudo-paralysis was a marked symptom. A case of Bone Syphilis in an Infant accompanied by Pseudo-paralysis, etc. (Phila. Medical Times, Oct. 11, 1879.)
[3] Two marked cases of hereditary syphilitic disease are shown in Figs. 331 and 333.

Dactylitis syphilitica is usually observed in very young children, but may occur as late as the twentieth year. It is characterized by swelling of the phalanges, followed in some cases by absorption. The metacarpal and metatarsal bones are likewise the seat of similar affections. The swellings in the latter case usually form rapidly, and attain considerable size; the integument may ulcerate. The treatment of all bone swellings should combine the administration of both mercury and iodide of potassium.

The following ointment may be used externally:—

> R.—Ung. hydrarg.,
> Ung. zinci ox. āā ℥ss.
> Bals. Peruv. ℨj. M.

Graduated pressure is often advantageous.

In connection with diseases of the osseous system in infants, reference may be made to the recent discussions on the relationship between rickets and hereditary infantile syphilis. The writings of Parrot, and the debate on the subject in the London Pathological Society, a year or so ago, may be referred to in this connection. As the subject is as yet confused and obscure, notwithstanding the recent attempts to shed light upon it, I do not think it profitable to enter into its discussion here.

CORNEA AND TEETH.—The affections of the cornea and of the teeth in hereditary syphilis demand a passing notice, on account of the diagnostic importance which has been attributed to them. Some years ago, Mr. Jonathan Hutchinson[1] brought forward the view that the peculiar inflammation of the cornea usually occurring between the ages of three and twenty, and known by the name of strumous keratitis, was always due to hereditary syphilis. This, which is a diffuse keratitis, gives rise to a hazy appearance of the cornea, causing it to look like ground glass. In connection with this condition of the cornea, certain changes in the teeth take place. The exact nature of these, and the appearances presented, having been frequently misunderstood, Mr. Hutchinson[2] gives the following memoranda for the avoidance of error in diagnosis.

1. No special peculiarities are to be looked for in the first set of teeth.

2. There can be no more serious blunder than to imagine that bad teeth in proportion to their badness of form are to be suspected of syphilis.

3. The upper central incisors are the only teeth which are positively characteristic. The others may afford corroborative testimony, but are not to be relied upon alone.

4. The chief peculiarity is a general dwarfing of the tooth, which is both too short and too narrow, and, from its sides slanting together, presents a tendency to become pointed. This tendency to pointing is always defeated by the cutting off of the end, the truncation being usually effected in a line curved upwards so as to produce a single shallow notch. At the bottom of this notch the enamel is deficient and the dentine exposed, but there is no irregular pitting, as in stomatitis teeth.

5. The malformations are unusually symmetrical, and affect pairs of teeth. The two central incisors resemble each other, and the two laterals are also alike. If any defect passes horizontally across all the incisors at the same level, and affects them all alike, it is probably not due to syphilis.

6. In syphilis the lateral incisors usually show little or no malformation.

7. The occurrence of the peculiarities due to syphilis and those due to mercury in the same mouth are exceedingly common.[3]

The importance to be attached to the characteristic appearance of the teeth in hereditary syphilis has been disputed by some observers. For myself,

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[1] Ophthalmic Hosp. Rep., vol. i. p. 229.
[2] Illustrations of Clinical Surgery, fasc. xi. London, 1878.
[3] I do not think that this remark will apply to America.

although I have carefully examined a considerable number of subjects of inherited syphilis, during the past few years, yet I cannot say more in favor of the diagnostic value of these teeth than that, when present in typical form, they have a certain weight in favor of the existence of hereditary syphilis in the given subject. I should hesitate to base a diagnosis in a doubtful case upon the evidence of the teeth alone. The annexed illustrations, some of which are taken from Hutchinson, and one from W. F. Norris, show several varieties of syphilitic teeth.

Fig. 335.   Fig. 336.   Fig. 337.
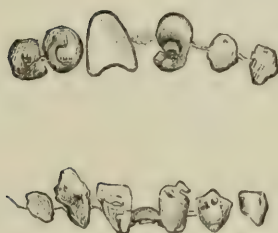
Fig. 338.   Fig. 339.   Fig. 340.

Syphilitic teeth.

AFFECTIONS OF THE NERVOUS SYSTEM.—The affections of the nervous system in hereditary syphilis have been studied chiefly by English physicians, and during the past decade.[1] Many cases of brain disease formerly believed to be of tubercular origin are now known or suspected to be syphilitic in character. The results of meningeal inflammation, such as thickening and adhesion of the membranes by the development of fibrous tissue and gummy material, and the endoarteritis often observed in syphilis of adults, have been noted in infantile syphilis. Gummata have also been observed, and the prevailing impression among investigators at present tends to the belief that the same nervous affections may occur in hereditary as in acquired syphilis.

Our present knowledge of these affections is, however, very incomplete. Jackson has described the chorea of hereditarily syphilitic infants and young children, which is sometimes a slight affection, while at other times it is more severe and may lead to epilepsy. Other writers have described cases of facial paralysis. The nervous affections of hereditary syphilis, like those of the acquired disease, are disorderly and complex in the development of their symptoms; a quite characteristic point.

[1] See Hughlings Jackson, Cases of Diseases of the Nervous System in Patients the subjects of Hereditary Syphilis. London, 1868; and Nervous Symptoms in Cases of Hereditary Syphilis (Journ. Mental Sciences, Jan. 1875); also Barlow (Trans. Path. Soc. Lond., vol. xxviii. 1877); and T. Stretch Dowse, The Brain and its Diseases. London, 1877.

What is known of these nervous affections should lead to the careful examination of every case of chorea, epilepsy, etc., occurring in children, with the view of ascertaining, if possible, the presence or absence of a syphilitic taint. In this connection, the rules for examining cases of suspected hereditary syphilis given by Mr. Hutchinson,[1] are of value.

He says that although the teeth taken alone are the most valuable signs in adolescents by which inherited syphilis is recognized, yet there are others of importance which will aid the diagnosis or supply the lack of information from the teeth. These are :—

(1) A group of physiognomical peculiarities : (a) sunken bridge of nose ; (b) prominent frontal eminences ; (c) scars at corners of mouth ; (d) silky softness of skin with absence of color.

(2) History of past attack (or evidence of present one) of interstitial keratitis. This disease usually affects both eyes and causes very great defect of sight, lasting over several months ; then it clears away, leaving the corneæ a little cloudy, or it may be perfectly bright. Afterwards there remains a peculiar steel-gray lustre on the iris.

(3) The presence in the choroid of scattered patches of absorption, especially in the peripheral regions. These will often afford conclusive evidence when other symptoms fail.

(4) The presence of periosteal nodes on one or on many of the long bones.

(5) The occurrence present or past of a peculiar form of phagedænic ulceration, sometimes erroneously called lupus. This may affect any part, but is often seen in the face or in the throat.

TREATMENT.—The treatment of hereditary syphilis must begin, when possible, with the fœtus in utero. The surest means of preserving the product of conception and bringing it to maturity, is in beginning the treatment of the mother at the earliest possible moment, and continuing it vigorously until after the birth of the child.

Mercurials are best given by inunction during pregnancy, as we by this means spare the stomach, and avoid the danger of intestinal irritation which may go so far as to cause the abortion which it is our object to prevent. There are some cases, however, in which inunction cannot conveniently be employed, and here mercurials by the mouth, if given with due precaution, are often well borne, and may at least be tried.

The infant, when born, should be placed under the best possible hygienic circumstances, and should be nourished at the mother's breast. No harm can come of this to either. Bottle-feeding is a very inadequate means of nourishment at best, and in the syphilitic infant may determine such failure in health as to cause the disease to take much firmer hold upon the system than it would do otherwise. It seems hardly necessary to say that the syphilitic infant should not be given to a wet-nurse, unless that nurse be herself syphilitic. This is sometimes done by mistake, in the case of infants not known to be syphilitic, with the gravest consequences—the disease being thus imported into a healthy family, and infecting, perhaps, several members.[2]

For the medical treatment of syphilis in very young infants, baths and inunctions are preferable. The best form of mercurial bath is made by simply dissolving ten grains of powdered corrosive sublimate in about a bucketful of water, employing a small tub just large enough for the child to sit in comfortably. The water, of course, should be warm, and the bath should be given with due precaution against cold. A flannel skirt tied around the infant's neck and spread over the tub, will prevent any of the

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[1] Illustrations of Clinical Surgery, fasc. xi.

[2] See Fournier, Nourrices et Nourrissons Syphilitiques, Paris, 1878 ; and R. W. Taylor, The Dangers of the Transmission of Syphilis between Nursing Children and Nurses in Infant Asylums and in Private Practice (Am. Journ. Obstet., vol. viii., Nov. 1875).

water from being splashed into the nose or eyes. The infant should be allowed to remain in the water at least ten or fifteen minutes, and should be then dried and powdered with starch—or, if there are any moist papules, these may be dusted with a powder of equal parts of calomel and oxide of zinc—and should then be put to bed. One bath should be given daily.

Many authorities object to the use of baths in hereditary syphilis, but I have had such good results from their use that I prefer them to all other forms of medication, where they can be used with safety and convenience.

The best method of employing mercury by inunction is in the form of a dilute mercurial ointment, such as the following:—

> R.—Ung. hydrarg. ℥j.
> Unguenti, ℥j. M.

This is to be smeared over a flannel roller, which is bound about the infant's body and changed once in twenty-four hours. Sir Benjamin Brodie, who strongly recommended this plan of treatment, said that he had never found it to fail.

The internal administration of mercury or of iodide of potassium to very young children, is neither necessary nor desirable; in fact, I think it objectionable, as I have often seen the stomach upset by the administration of these drugs. In the case of older children, however, it may sometimes be desirable to administer the medicines in this manner. One of the best forms of giving mercury to children is in "gray powder," as follows:—

> R.—Hydrargyri cum cret. gr. ij ad vj.
> Pulv. sacch. alb. gr. xij. M.

To be divided into twelve powders; one three times a day.

The following formula (a modification of the well-known *Sirop Gibert*) is convenient when it is desirable to employ the "mixed treatment":—

> R.—Potassii iodidi, gr. v.
> Hydrargyri biniodidi, gr. $\frac{1}{10}$.
> Syrupi, f℥iij.
> Aquæ, ad f℥ij. M.

Teaspoonful three times a day for a child of a year old, with an increase proportional to that of the age.

The treatment should be continued for a considerable time—at least three or four months—after all symptoms have disappeared.

The attempt has often been made to give mercury and iodide of potassium to infants through the medium of the mother's milk, but the effects have not been so decidedly favorable as to suggest this as an appropriate method. I am inclined to doubt if mercury can be given in this manner, but I believe that experiment has shown that iodide of potassium is found in the milk of nursing women to whom it is being administered by the mouth.[1]

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[1] The following papers may be referred to as giving additional information on subjects connected with hereditary syphilis:—

Atkinson, An Account of a Case of Syphilis inherited through Two Generations (Archives of Dermatology, Jan. 1877);

Bulkley, Rare Cases of Congenital Syphilis (New York Med. Jour., May, 1874);

Id., Two Cases of very late Hereditary Syphilis (Archives of Dermatology, April, 1878);

Hyde, On the Immunity of certain Mothers of Hereditarily Syphilitic Children (Transactions of the American Dermatological Association, Archives of Dermatology, April, 1878);

Atkinson, Late Hereditary Syphilis (Am. Jour. Med. Sci., Jan. 1879); and

Hyde, The Nurse-maid and the Mother of the Syphilitic Child (Chicago Med. Jour. and Exam., Nov. 1878).

GENERAL TREATMENT OF SYPHILIS.

EXPECTANT TREATMENT.—A certain number of cases of syphilis run so mild a course that, even if left to themselves and entirely untreated, they would tend to spontaneous recovery. The observation of such cases has led a few observers to imagine that, the disease being in so many instances mild and benignant, no treatment is required, unless unusual complications should arise. But even in the mildest cases, such symptoms as do arise are, if untreated, apt to persist for much longer periods than if treatment were employed, and patients thus deprived of treatment are apt to grow despondent and dissatisfied. In addition, it must be remembered that cases which may at first appear likely to run a mild course, not infrequently show severe symptoms at a later date.

Considering, also, the fact that all, or nearly all, prejudice against the use of mercury has died out in the profession and among the public, there can exist no reason, in the vast majority of cases, why energetic anti-syphilitic treatment should not be employed vigorously in every case.

HYGIENIC AND GENERAL TONIC TREATMENT.—In order to treat syphilis successfully, careful attention must always be paid to the patient's general condition and surroundings. Bad air, insufficient clothing, and scanty or improper food, often cause great aggravation of symptoms, which, under favorable conditions, would be of comparatively little moment. This is strikingly observed in hospital practice in any of our large cities, where syphilitic patients, brought in from the slums in a deplorable condition, rapidly recuperate under the influence of a carefully regulated diet and regimen. I am accustomed, in many cases where the patient's condition is broken down and depraved, to avoid the employment of specific remedies for a time, even when threatening symptoms are present (unless the brain is attacked), and to begin treatment by the employment of nourishing diet, stimulants, and tonics, and I have not infrequently observed the happiest results from this procedure in cases which had been steadily deteriorating and growing worse under a strongly pushed course of specific medication.

The patient under treatment for syphilis should live regularly, employ simple but nourishing diet, abstain from the free use of stimulants and tobacco, pay attention to the functions of the skin and bowels, and take as much exercise in the fresh air as circumstances will permit. Under the head of regularity of living, the careful restriction of the appetites and, particularly, the sexual desires, must be insisted upon. In nervous syphilis, above all, the consequences of venereal excesses are most deplorable.

Persons who have been accustomed to the use of stimulants should not be deprived of alcohol in every shape, but may be treated with the bitter tinctures, such as the tincture of gentian and the like.

A cheerful disposition on the part of the patient should be cultivated by the physician, not only as assisting the action of the remedies, but as tending to prevent that unfortunate melancholic habit of mind which is known as syphilophobia, and which, when firmly established, is often irremediable. Persons suffering with this delusion fancy themselves incurably saturated with syphilitic poison, and at times, no assertion of his perfect health, given by the physician, will set the patient's mind at rest.[1]

Examination of the blood of patients in the early stages of syphilis, shows chloro-anæmia, or a diminution in the proportionate quantity of red blood

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[1] Cases have been repeatedly reported of syphilophobic patients having committed suicide.

corpuscles. Iron is, therefore, called for in many cases, either alone or combined with the specific remedies. In the majority of cases, the tincture of the chloride is the most available form of ferruginous medication, although I frequently use the dried sulphate of iron, or the tartrate, in the form of wine of iron; the tincture may be occasionally used alone, or more frequently, as with the last two preparations, combined with the specific remedies. The bitters, such as quinine and gentian, are frequently called for, and occasionally the mineral acids may be resorted to in appropriate cases.

SPECIFIC TREATMENT.—The chief remedies in syphilis are the various preparations of mercury and iodine. Although in the discussion of the various manifestations of the affection in the preceding pages, some mention of peculiarly appropriate forms of treatment has been made, it remains in this section to set forth the general principles of the specific treatment of syphilis, and to indicate those preparations and applications which experience has shown to be generally useful in dealing with the various lesions as they may arise.

Mercurial preparations are most generally useful in the earlier stages of syphilis, while the iodides come into play in the later forms. As no hard and fast line can be drawn between the "early" and "late" lesions, commonly so called, so no invariable rules can be laid down for the administration of one class of remedies or another; each case must be treated on its merits, and one or the other remedy, or both together, must be given as the occasion demands.[1]

MERCURIALS.—Mercury came into use in the early history of syphilis, and though violently assailed from that time to this, has held its own as an invaluable remedy. Even its abuse in a past generation, when salivation was considered a condition to be aimed at in the treatment of all venereal disease, has never caused it to lose its hold upon the esteem of the profession.

As regards the period at which the administration of mercury should begin, it is now agreed by most syphilographers that nothing is gained by its too early administration. Given on or shortly after the appearance of the initial lesion, its effect is to delay and render irregular the advent of the generalized lesions, without preventing their eventual appearance. An element of confusion is thus introduced into the orderly evolution of the various manifestations, and occasionally the delay in their appearance gives rise to false hopes of a permanent cure, often rudely dispelled by an unexpected outbreak, or perhaps by the transmission of the disease to an innocent person.

It will not do, however, to leave the patient entirely without treatment, and it is better, therefore, when the diagnosis of chancre is made, or even when the existence of the initial lesion of syphilis is suspected, to begin the administration of internal remedies, perhaps iron and quinine, warning the patient at the same time of the probable supervention of general manifestations, but waiting until these actually appear before instituting mercurial treatment.

The choice of the form in which mercury shall be administered is often dependent upon nothing more than personal preference. It must be remembered, however, that the same preparation is not suitable in every case, nor in the same case at different periods, and a trial must often be made of several different preparations before the one best adapted to the case can be selected. When any given preparation seems to lose its effect, it is generally

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[1] See Hutchinson, When and how to use Mercury in Syphilis. Am. Journ. Syph. and Derm., vol. v., 1874, p. 112.

better to change it for another rather than to increase the dose to any considerable extent, which might disarrange the stomach or bowels.

The preparations of mercury which I am most in the habit of using are the pil. hydrarg. and the protiodide. The former preparation and the mercury with chalk are the two forms of the drug chiefly employed by Bumstead and Taylor, while the protiodide is preferred by Keyes. Whichever of these preparations is used, it should at the outset be given with caution, since the patient's susceptibility is not generally known before trial, and salivation is to be avoided. The following formula is given by Bumstead and Taylor. I have used it, with or without the opium, in hundreds of cases, and consider it a convenient and practical prescription:—

> R.—Pil. hydrarg. gr. xl.
> Ferri sulph. exsiccat. gr. xx.
> Ext. opii, gr. v.   M.

Divide into twenty pills, one to be taken from two to four times a day.

The following formula for mercury with chalk is given by Bumstead and Taylor:—

> R.—Hydrargyri cum creta, gr. xl.
> Quiniæ sulphatis, gr. xx.   M.

Divide into twenty pills, one of which is to be taken from two to four times a day.

The dose of the protiodide is from one-sixth to one-third of a grain, thrice daily. Given in larger doses than half a grain, it is apt to disagree, and to cause griping and diarrhœa. In order to prevent intestinal irritation, the protiodide may be taken half an hour after eating, or, if necessary, it may be combined with a little opium. The sugar-coated granules, as made by trustworthy pharmaceutists, afford a convenient method of administering the protiodide; made as small as the one-fifth of a grain, the dose may be gradually increased and carefully regulated.

The biniodide of mercury is a favorite form of administering the drug with many practitioners, among whom I may mention my friend, Prof. Duhring, whose extensive experience with this preparation in the treatment of syphilitic skin manifestations leads him to think very favorably of it. It may be administered alone, but is more usually combined with the iodide of potassium. The following formula, the time-honored *Sirop Gibert*, is one which I frequently prescribe:—

> R.—Hydrargyri biniodidi, gr. j.
> Potassii iodidi, ℨj.
> Aquæ, fℨj.
> Filter through paper and add
> Syrupi simplicis, fℨv.   M.

Dose, a tablespoonful.

Some patients object to the cloying sweetness of this preparation, in which case water alone may be employed, or wine of iron may be substituted for part or the whole of the syrup.

Occasionally it is found convenient to separate the mercurial and the iodide of potassium, in which case one may be given while eating, and the other half an hour or more after meals.

The bichloride of mercury is not as frequently employed as formerly; nevertheless it is a good remedy, though it does not generally act as quickly as the other preparations mentioned. I usually prefer to prescribe it in solution, and commonly make use of the formula known as the "liquor of Van Swieten," which is composed as follows:—

Bichloride of mercury, 1 part.
Water, 900 parts.
Alcohol, 100 parts.

Dose, a tablespoonful, given in a wineglassful of pure or of sweetened water, according to the taste of the patient.

The bichloride may also be given in one of the bitter infusions, or in combination with the tincture of the chloride of iron, as thus :—

℞.—Hydrargyri chloridi corrosivi, gr. ij.
Tinct. ferri chlor. f℥iv.
Aquæ, ad f℥iv. M.

Dose, a teaspoonful in a wineglassful of water.

If it is desired to give the bichloride in pill form, the following (Sturgis) is a good combination :—

℞.—Hydrarg. chlor. corrosiv. gr. $\frac{1}{16}-\frac{1}{8}$.
Saponis, q. s. ut fiat pil. una. M.

One thrice daily after meals.

In order to check its action upon the bowels from one-quarter to half a grain of opium may be added to each pill.

General Principles of the Administration of Mercury.—The method of administering mercury, the period during which it is to be given, and the proper average dose of the various preparations, must now be considered.

In former times the object aimed at was to salivate the patient, and, this end once attained, the disease, it was thought, might be considered cured. At the present day salivation is universally regarded as a catastrophe to be avoided, and it only occurs as the result of mischance. Two plans of treatment are usually recommended by modern writers, the treatment by "courses" of mercury, with intervals of rest between the series, and the so-called "tonic," or continuous treatment by small doses. The latter plan has been brought into prominence of late years by the writings of Keyes, of New York.[1]

The preparation usually employed by Keyes is the protiodide of mercury, and he prefers the accurately made French granules of Garnier and Lamoureux, each of which contains exactly one-sixth of a grain, although several American-made gelatine-coated pills are equally good. In the rare cases in which the French granules cause griping, Keyes recommends blue pill, according to the formula given above, only in half grain doses, with a quarter of a grain of the dried sulphate of iron.

To bring a patient under the tonic treatment, if there be time, Keyes recommends the following course :—

" Let him take one standard dose of mercurial (one granule of the protiodide, for example) after each meal, for two or three days. On the fourth day one extra standard dose is added at the mid-day meal; now four standard doses (granules) are taken daily, and this is to be continued for three days [when a fifth is added].

" On the succeeding fourth day another standard dose is added, two standard doses being now taken after each meal—six granules a day."

The dose is thus increased every third or fourth day, the patient living regularly, and taking bland food until the gums are touched, or until diarrhœa and griping are experienced. When the symptoms are urgent, or when for

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[1] (a) The Effect of Small Doses of Mercury in modifying the number of the Red Blood Corpuscles in Syphilis. (Am. Journ. Med. Sci., Jan. 1876.) (b) The Internal Treatment of Syphilis. An essay read before the International Medical Congress in Philadelphia in 1876. (Transactions of Int. Med. Congress, Phila., 1877.) (c) Tonic Treatment of Syphilis. New York, 1877. (d) The Venereal Diseases. New York, 1880.

any other reason it is desirable to make a rapid impression, fumigation, inunction, or the administration of $\frac{1}{16}$ grain of the corrosive chloride in tincture of bark, taken diluted after meals, may be employed, and then, when the urgent symptoms have fairly declined, all medication may be suspended for a week or two, after which the course sketched above may be regularly instituted.

" When a dose of six, nine, or even twelve granules a day, in some cases, has been reached, it will produce a very positive attack of diarrhœa, with pain in the intestines, and occasionally at the same time the breath will begin to have the mercurial fetor, and the livid line will begin to show faintly along the edge of the gums, while the teeth themselves become a little sensitive on being snapped sharply together, and the saliva flows more freely."

Diarrhœa and griping, however, are more apt to be met with in using the protiodide than are the mouth symptoms.

When either set of symptoms occurs, the patient is taking what Dr. Keyes calls his "full dose," which is anything but tonic, and which is only to be kept up, with the aid of bland food and a little opium, until the urgent symptoms are overcome. It is then dropped to one-half, which is the "tonic dose," and may be continued steadily during several years without injury to the patient, indeed to his advantage as regards his general condition. When, however, the syphilitic symptoms have subsided, a still less quantity, perhaps one-third of the "full dose," is required. This dose is also tonic, and is to be persisted in daily, year in and year out, alterations being made from time to time, according to the varied necessities of the particular case.

During the existence of moderate symptoms the tonic dose may be continued, but if special outbreaks occur, more active measures, in the shape of increased doses, fumigations, etc., may be resorted to temporarily. When the period of late lesions arrives, if an outbreak occurs, the iodides are to be used temporarily, and the tonic course again resorted to when the emergency is past.

As regards the period during which the tonic course should be given, this must vary in different cases. About three years is a full course for most people, while two years and a half, or even two years, answers well enough in some cases. Six months—or better, an entire year—of immunity from symptoms is desirable, before the tonic treatment is stopped.

I have given Dr. Keyes's plan of treatment at some length, both because it is not as well known as the older plans, and because it has commended itself to me, after some years of personal experience, as decidedly the best and most rational. It is often difficult to induce patients to follow out such a prolonged course of treatment. The symptoms once fairly gone, the patient gradually forgets the serious nature of the affection from which he has suffered, and this diminishes in importance in his mind while the continual dosing becomes more and more irksome. For this reason I have frequently failed in inducing patients to prolong the treatment for any considerable length of time after the disappearance of all visible signs of the disease. I have, however, succeeded in some instances; and even when the course of treatment has not been prolonged to the extent which I should have desired, the effect has been so satisfactory that I employ this to the exclusion of all other methods.

Salivation.—Although mercury is rarely given in large doses at the present time, and salivation is consequently of very unusual occurrence, yet this complication does occasionally arise, owing to some idiosyncrasy of the patient, or to some other cause, and it must be dealt with and relieved as quickly

as possible. It is a good plan to employ a mouth-wash during the administration of mercurials, such as the following :—

> R.—Potassii chlorat. ℨj.
> Aquæ, f℥vj. M.

Sig.—Use as a mouth-wash three or four times daily.

This may be combined with an aromatic astringent, as in the following elegant preparation :—

> Chlorate of potassium, ℨss.
> "Eau de Botot," f℥ij.

A teaspoonful in a wineglassful of water, as a gargle.

If salivation has actually set in when the patient is seen, the first of these formulæ may be administered internally in teaspoonful doses four or five times daily, or belladonna may be given as in the following (Sturgis):—

> R.—Tinct. belladonnæ, f℥iv.
> Aquæ, f℥ij. M.

Sig.—Teaspoonful four times a day in water.

Atropia may be preferred in severe cases:—

> R.—Atropiæ sulphat. gr. $\frac{1}{10}$.
> Alcoholis, f℥ss.
> Aquæ, q. s. ad f℥ij. M.

Sig.—Teaspoonful three or four times daily.

The chlorate of potassium may be employed simultaneously. When the gums are spongy, and the teeth are loosened and appear ready to drop out, nitric acid should be given internally and locally.

> R.—Acid. nitric. dil. f℥iv.
> Aquæ, f℥ij. M.

Sig.—Teaspoonful four times a day in water; also use locally, diluted with water.

Keyes recommends chlorate of potassium, in solution in cold tea, about one or two drachms to the pint, with a scruple of carbolic acid. The carbolic acid is particularly called for by the fetor of the breath, and to sweeten the foul secretions of the mouth. He also recommends the employment of hypodermic injections of a solution of atropia (gr. j to f℥j), five minims of which may be thrown under the skin—the influence on the pupil being watched, and the dose repeated every four or six hours until the pupils are widely dilated. The effect of this remedy upon the salivary secretion, says Dr. Keyes, is often very prompt, and the general influence over salivation quite marked.

Sulphide of calcium, in from one-tenth to one-fifth grain doses every three hours, is a remedy which has been highly commended, but which, in my experience, has not proved very satisfactory.

Fumigation.—Mercurial fumigation, formerly much employed as a remedial agent in syphilis, fell for a time into disuse, but has been revived again of late years, chiefly through the efforts of Mr. Langston Parker, of Birmingham, England, and more lately through those of Mr. Henry Lee. The vapor may be generated from metallic mercury, calomel, mercury with chalk, the bisulphuret, the gray oxide, or the binoxide. The amount to be used varies from twenty to one hundred and twenty grains, according to the effect desired.

Calomel is the best agent for ordinary employment, and the simpler the apparatus used the better. Water is usually vaporized simultaneously with the mercurial. Bumstead and Taylor give two cuts illustrating the best apparatus for vaporizing by means of an alcohol lamp or by gas. An

extemporaneous apparatus can readily be arranged, or the corrosive sublimate may be dissolved in water, and subjected to ebullition by any ordinary process. A simple apparatus may be made by bending a piece of tin into a table, or a brick may be heated, and the calomel sprinkled upon its surface, a pail of boiling water being at the same time placed by its side under the chair on which the patient sits. The patient should be clothed in a long sleeveless flannel gown of ample dimensions, over which should be placed a somewhat similar garment of India-rubber "Mackintosh" cloth. He should sit upon a cane-seated chair, under which the fumigating apparatus should be placed, the flannel gown and Mackintosh covering the whole seat and apparatus. The lamp being lit, vapor of water is first generated, enveloping the patient in a steam which soon provokes a free perspiration. As the temperature of the apparatus rises, the calomel also becomes vaporized, and is readily absorbed by the skin. As soon as the mercury has disappeared, the light is put out, and the patient remains seated and covered with his bath-clothes until the body begins to cool slightly. The rubber coat is then removed, and the patient is wrapped in blankets until all perspiration has ceased, and the body has become cool and tolerably dry, when he may put on his ordinary clothes again. But it is better to give the bath at bedtime, and let the patient retire immediately, sleeping in his flannel gown.

The fumigation treatment is one which it is not always easy to employ in private practice, but it is I think the best and most efficient form of medication when there is an extensive and stubborn eruption of the skin which fails to yield readily to internal treatment, when the greatest rapidity of cure is desirable, or in cases where the patient's stomach is weak, and it is desirable to save it in every way. Occasionally patients complain of a feeling of debility and headache, which may be obviated by using less steam, and by diminishing the length of the bath. Diarrhœa, and occasionally, though rarely, salivation, are also observed in some cases. The frequency of the baths should be determined by the strength of the patient and by the degree of mercurial action desired. In early syphilis, when the patient's strength is fair, the bath may be given every night, but in late syphilis, when a rapid effect is not required and when patients are debilitated, two or three times a week is sufficiently often.[1]

Inunction.—Inunction, though an uncleanly and to many persons repugnant form of treatment, is one which is very efficient, and in some cases invaluable, as a means of rapidly impressing the system, or of producing the effects of mercury while saving the digestive organs. The plan formerly employed, and still not uncommonly resorted to, is that of rubbing a quantity of unguentum hydrargyri into various portions of the integument in succession. Taking the groin, for instance, on the first day, and rubbing a piece of the ointment the size of a hazel-nut or a small walnut thoroughly into the skin, the other groin is selected for the next day's operation, then one axilla, and the other, etc., until the surface is entirely gone over. The constant state of greasiness thus produced is very disagreeable, and almost intolerable to a fastidious person, and the evil is only mitigated in part by the use of the more elegant preparations of the oleate of mercury. For this reason I have of late years usually employed the following method, which was first brought to my notice by one of Dr. Sturgis's writings. The patient bathes the feet thoroughly in hot water the night on which the first inunction is made, when half a drachm of oleate of mercury of 20 per cent. strength is rubbed briskly into

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[1] A very good article on mercurial fumigations is that by Prof. D. W. Yandell, published in the American Practitioner, Louisville, Sept. 1877.

the sole of the right foot; this is repeated the next night on the left foot, and so on alternate nights the right and left foot are anointed with half a drachm of the preparation. This may be increased to a drachm or more if the patient stands the mercurial well. The stockings should be worn continuously night and day for a week, at the expiration of which time the feet may be thoroughly cleansed with hot water and soap, and the treatment suspended for a few days, and then recommenced. The unguentum hydrargyri may be used instead of the oleate of mercury, and in fact I commonly prefer it to the more elegant preparation, because it seems to me that it is absorbed more readily.

During the inunction treatment, the condition of the mouth and gums is to be carefully looked after, and it is well to use one of the astringent washes given above.

Mercurial suppositories, composed of about half a drachm of mercurial ointment and a sufficient quantity of butter of cacao, introduced into the rectum at night, have been employed. I have never used them, and as they give rise to local irritation, I think they are not to be recommended.

Hypodermic Injection.—The hypodermic injection of mercurials for the treatment of syphilis has been highly recommended by a number of European authorities,[1] but has never found extensive employment in this country, since the injections are followed by considerable pain, often lasting for some hours, and since, in spite of every precaution, abscesses will occasionally form at the point of insertion of the needle.

Bumstead and Taylor recommend the following formula:—

> R.—Hydrarg. chlor. corros. gr. xl.
> Glycerinæ, f℥j.
> Aquæ destillat, f℥vj.   M.

Twelve drops of this solution contain about one-eighth of a grain of the sublimate, and are used for each injection.

In employing mercury by hypodermic injection, a comparatively insensitive portion of the skin should be selected, and a locality where abscesses are not very apt to form. The infrascapular regions, the loins, and the upper portions of the nates are the best points for the introduction of the needle. As it is supposed that mercury exerts a local action in hastening the disappearance of the lesions, it may in some cases be advisable to employ the injections in or near affected parts. The same syringe should never be used on syphilitic and non-syphilitic persons. The point of the needle should be kept sharp and polished.

The hypodermic method is objected to by patients in private practice, and it is best to confine its employment to such cases as from some cause may contra-indicate the use of other methods of treatment, or where it is desirable to get the full effect of the drug with great rapidity. Patients are unquestionably relieved from external symptoms with more rapidity by this method than by other modes of treatment.

IODINE AND ITS COMPOUNDS.—Iodine and its compounds are ordinarily useful in direct ratio to the duration of the disease. Their action on the early

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[1] See Wigglesworth, Subcutaneous injection of corrosive sublimate in syphilis (Boston Med. and Surg. Jour., Aug. 26, and Sept. 2, 1869); Lewin, Behandlung der Syphilis mit subcutaner Sublimat-injection. Berlin, 1879 ; Staub, Traitement de la Syph. par les Injections Hypodermiques de Sublimé à l'état de Solution Chloro-albumineuse. Paris, 1872 ; Bamberger (Zeit. d. Öest. Ap. Ver., 1876, 147, 177 ; and New Remedies, New York, 1876, pp. 167, 175) ; Günz, Ueber subcutane Injection mit Bicyanuretum Hydrargyri bei syphilitischen Erkrankungen (Wien. med. Presse, 1880).

lesions of syphilis is slight, but on the later lesions, especially gummatous tumors, affections of the bones, brain-troubles, etc., the influence of iodine is sometimes almost magical. The iodine compounds alone do not, however, as a general thing, possess the power of permanently removing the lesions which they cause to disappear so quickly, and mercury must usually be resorted to in order to obtain a permanently favorable result.

The dose of the iodides must vary greatly with different cases. In mild cases, the iodide of potassium—which may be taken as a representative of the class—may be given in doses of from two or three to eight or ten grains three times a day; but in brain-troubles, it is sometimes necessary to give the remedy immediately in large doses, and frequently as much as an ounce or more is taken thus by the patient in the course of twenty-four hours.

The iodide of potassium may be given in five-grain compressed pills or in solution. I think it less apt to disagree in the latter form. As it is very soluble in water, this fluid may be used as a menstruum with or without any adjuvant. I commonly give the iodide of potassium in water alone, as I think that the various flavoring substances which are employed, often fail to do more than partially disguise the nauseous metallic taste of the drug, and not infrequently give a strange and repulsive flavor to the mixture. The following formula is one of the best when it is desired to hide the taste and appearance of the drug, as far as may be, and when a ferruginous tonic is required:—

> ℞.—Potassii iodidi, ʒvss.
> Vini ferri, fℨiv. M.
> A teaspoonful contains ten grains of the iodide of potassium.

The action of iodide of potassium appears, I think, in some cases, to be increased by the addition of the carbonate of ammonium, as in the following formula:—

> ℞.—Potassii iodidi, ʒiij.
> Ammonii carbonat. ʒiss.
> Vini ferri, fℨiv. M.
> A teaspoonful contains six grains of iodide of potassium and three grains of carbonate of ammonium.

Iodide of potassium agrees best when given from half an hour to an hour after eating. Griping, which is sometimes experienced, may often be obviated by the addition of a syrup containing tannic acid, added in substance, or as it occurs in cinchona or in orange peel, as in this formula:—

> ℞.—Potassii iodidi, ʒj.
> Syr. aurantii corticis, fℨvj. M.
> Dose, a tablespoonful, containing five grains of iodide of potassium.

When giving iodide of potassium in large doses—and, in fact, when giving it in any case in which it is found to have a tendency to disorder the stomach—I add Vichy water, as suggested, I think, by Keyes, directing the patient to pour into a small tumbler the dose desired to be taken of the simple aqueous solution of the iodide, and then to turn in a wineglassful or more of artificial Vichy water, from a portable fountain, such as is sold in the shops. This combination makes the iodide easier to take, and causes it to agree better with weak stomachs.

The usual dose of iodide of potassium is from five to ten grains thrice daily, but this may, and often should be, surpassed in serious cases, especially when threatening symptoms show themselves. Symptoms will often yield to drachm doses which have stubbornly resisted ten-grain doses, and no case should be pronounced intractable to the iodide until this has been pushed to large amounts.

The iodides of sodium and of ammonium may occasionally be substituted for the iodide of potassium, where they agree better with the patient, or where a change is for any reason desirable. Iodide of iron is not very efficient, but may occasionally be employed as a tonic or succedaneum, or in the case of children.

Iodine, in the form of the tincture, may occasionally be employed when the iodides disturb the stomach. Keyes suggests the administration of the tincture in doses of ten drops in a tablespoonful or more of starch-water, and increased up to eighty drops in a claret-glass of the diluting fluid.

The contra-indications to the use of iodine in any of its forms are, acute or chronic inflammations of the digestive organs, plethora, and a predisposition to hemorrhages. Acute catarrh sometimes comes on at the very beginning of a course of iodide of potassium; the patient sneezes and coughs, the eyes grow red and watery, the nose runs, and sometimes there is a severe headache across the brow. Very often the patient gets accustomed to the remedy, and these symptoms wear away, while in other cases, a temporary stoppage of the iodide, and a beginning again in smaller doses, gradually increased, will enable him to take the medicine with impunity; in other cases, however, the idiosyncrasy is unconquerable, and the drug must be stopped. The headache may sometimes be remedied by adding a diuretic, a little bromide of potassium, or a small quantity of opium, to the iodide.

The iodides produce, at times, a variety of eruptions, commonly acneiform or hemorrhagic, but occasionally closely resembling the lesions of syphilis.[1] The addition of small quantities of arsenic (5 to 10 minims of Fowler's solution) to the dose of the iodide will often prevent the appearance of these eruptions.

Bright's disease of the kidneys is said to be produced in some cases by the prolonged use of iodide of potassium, but the assertion has never been supported by entirely adequate evidence. Dr. I. Edmondson Atkinson, of Baltimore, in a recent paper on the subject,[2] after reviewing the cases and arguments brought forward on one side or the other of the question, and comparing them with the results of his own experience, concludes that while the occurrence of severe alterations of the kidneys as the effect of iodide of potassium is probable in rare cases, yet that there is no constant tendency on the part of the kidneys to resent its employment.

MIXED TREATMENT.—The combination of mercury and iodine has been a favorite form of administering these remedies for many years. It has its disadvantages, however, and should never be resorted to without reason. Many practitioners prescribe mercury and iodide of potassium in every case of syphilis, or even in every suspected case, upon the principle of the sportsman who shuts his eyes and fires both barrels of his gun, hoping that something will be hit somewhere. But in the earlier stages of syphilitic disease mercury is not only a sufficient, but is the best remedy, and iodide of potassium, if added to it, not only does not hasten the cure, but by tending to upset the stomach and interfere with digestion, may lose the surgeon the aid of this important organ just when it is most required, to digest the food with which the patient's strength is to be kept up, and to absorb the drugs which cannot be administered conveniently in any other way.

The "mixed treatment" therefore should be reserved for stubborn cases where one or the other remedy has failed, or where, as in late syphilis, the appearance

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[1] For a description of these, see a paper, by the author, on Medicinal Eruptions, read before the American Dermatological Association. (Archives of Dermatology, Oct. 1880.)

[2] May Iodide of Potassium excite Bright's Disease? Amer. Journ. Med. Sci., July, 1881.

of gummatous lesions calls for direct medication to resolve them, while at the same time the tonic treatment of mercury is to be kept up.

Among the various forms in which iodide of potassium and mercury may be administered in combination, the "Sirop Gibert" (the formula for which has already been given), is, I think, as good as any. Keyes recommends the following :—

> R.—Hydrarg. biniodid. gr. ss ad ɟ.
> Potassii iodidi, ʒij.
> Ammonii ididi, ℥ss.
> Syr. aurantii corticis, f℥ij.
> Tinct. aurantii corticis, fʒj.
> Aquæ destillatæ, q. s. ad f℥iv.   M.

Dose, a teaspoonful, containing $\frac{1}{64}$ grain to a $\frac{1}{32}$ grain of the biniodide of mercury, and four grains of the iodide of potassium.

When it is desired to give the corrosive chloride of mercury combined with iodide of potassium, this formula may be employed :—

> R.—Hydrarg. chlor. corrosiv. gr. j.
> Potass. iodid. ʒiss.
> Vini ferri, f℥iv.   M.

Dose, a teaspoonful.

I sometimes give protiodide of mercury pills at the same time as the solution of iodide of potassium, or the pills before and the iodide after meals. Another method of employing the "mixed treatment" is to prescribe mercury by inunction, and the iodide of potassium internally.

LOCAL TREATMENT.—I have said something about the local treatment of the various syphilitic affections when dealing with the latter in the earlier portion of this article. At the risk of some repetition, however, I think it well to give some general suggestions and formulæ for the treatment of such lesions as can be reached by local agencies.

The local treatment of chancre has already been sufficiently described, as have also the local applications employed in alopecia, and in the lesions of the mucous membranes. (See pages 474, 508, 510.) I may add here, however, a very elegant, and also a quite useful formula for a mouth wash, to be used by way of prophylaxis in the earlier months of syphilis :—

> Eau de Botot, f℥vj.
> Tincture of cochlearia, fʒiss.
> Tincture of cinchona, fʒij.
> Tincture of catechu, fʒj.
> Tincture of benzoin, fʒss.

A small quantity is mixed with water and used as a gargle morning and evening, and after meals.

The necessity of absolute cleanliness need hardly be mentioned. Where there is any discharge, whether from a suppurating lesion upon the skin, or from any of the cavities of the body, that discharge should never be allowed to accumulate. There is no "laudable" pus in syphilis : the discharges are all poisonous. In addition to the free use of soap and water, disinfectant washes, such as Labarraque's solution of chlorinated soda, may be employed, or those containing carbolic acid; such as the following:—

> R.—Acid. carbolic. fʒiss.
> Glycerinæ, f℥ss.
> Aquæ, ad. f℥viij.   M.

To be used in a state of more or less dilution, according to the locality.

Labarraque's solution, diluted with from three to six times its bulk of water, forms a good disinfectant wash in ozæna.

Of other washes which may be employed in suppurating lesions of the skin, to stimulate to healthy action, *lotio nigra* or black wash, and *lotio flava* or yellow wash, are the most generally useful. The latter is much the more stimulating of the two, and forms an admirable dressing for suppurating gummata and tubercular ulcerative lesions.

A still stronger, almost caustic, wash is the following:—

> ℞.—Hydrarg. chlor. corros. gr. iv.
> Alcoholis, f ℥j. M.

This should be used with caution on delicate surfaces, but is an admirable means of hastening the cure of moist papules. It may be rubbed without fear into the palm and sole, where the epidermis is thick.

Certain powders come into play in the treatment of moist and suppurating syphilitic lesions, prominent among which is iodoform. The disagreeable odor of this drug almost forbids its use in private practice, and its employment in syphilis is now so well known that the individual who goes about smelling of it is a marked man, and might almost as well bear a placard about his neck worded "syphilis." I have observed such persons in passing them on the street. For this reason the drug should not be employed except in case of dire necessity, that is, in late, deep, or serpiginous ulcerative lesions, when we must strain every nerve even to keep the patient from relapsing and going back. In hospital practice iodoform may be used freely and with great advantage. When it gives pain, as it sometimes does, although ordinarily its effect is just the reverse—distinctly anæsthetic—the iodoform may be mixed with two or three parts of tannic acid powder. The following snuff is recommended in the nasal catarrh of syphilis:—

> ℞.—Pulv. iodoformi,
> Pulv. camphoræ, āā ℨj.
> Pulv. acaciæ, ℨij. M.

Other powders are those of calomel, and the powder of savin and burnt alum, used in vegetating syphilodermata after these have been carefully cleansed with Labarraque's solution. The latter is composed as follows:—

> ℞.—Pulv. sabinæ, ℨj.
> Pulv. aluminis, ℨiv. M.

Tannic acid and chromic acid are also occasionally employed in powdered form. The latter should be used with caution, and only when a distinctly caustic effect is desired.

The ointments employed in the local treatment of syphilitic lesions are very numerous. A comparatively small number, however, are in reality sufficient, and all beyond this are required only in the interest of variety or individual fancy, or occasionally to meet particular indications.

The early generalized skin eruptions require no local treatment by ointments. The erythematous syphiloderm is unaffected by outward applications. The papular and pustular eruptions, as these occur upon the face, may, however, be treated locally with a view to hasten their removal, and ointments may also be advantageously used for the speedier resolution of moist papules about the genitalia and anus.

Among the milder preparations, ammoniated mercury ointment may be employed, as thus:—

> ℞.—Hydrarg. ammoniat. gr. xx–xxx.
> Ung. aquæ rosæ, ℥j. M.

Calomel may also be used in ointment of half the above strength, that is, from ten to twenty grains to the ounce.

A very good, drying ointment, which may be used in moist papules or small ulcers, is the following :—

> R.—Hydrarg. chlor. mitis, gr. x–xxx.
> Pulv. zinci oxidi, ʒj.
> Ung. aquæ rosæ, ℥j.   M.

Oleate of mercury in the strength of from five to ten per cent. is a very good application in the dry and scaly eruptions, particularly those occurring on the palms and soles, while an ointment like the following may often be used with advantage in ulcerative lesions :—

> R.—Hydrarg. oleat. (5–20 per cent.),
> Vaselini, āā ℥ss.   M.

I rarely employ the unguentum hydrargyri as a local application, because it is a dirty looking substance, and no more efficient than the white precipitate ointment given above.

In addition to the plasters which have been mentioned in previous parts of this article, the following may be recommended as particularly useful in those chronic and indurated scaly eruptions of the palm which are so rebellious to treatment of any kind :—

> R.—Hydrargyri, ʒj.
> Terebinthinæ, ʒj.
> Emplast. plumbi, ʒijss.
> Resinæ, ʒss.   M.

This makes an exceedingly tenacious plaster which may be applied to the palm, previously softened by repeated dipping in very hot water. It may be rubbed in, or, better, spread upon one or more strips of muslin arranged so as to wrinkle as little as possible, and changed once a day or oftener. I have found this to succeed in obstinate cases when all else has failed.

Tuberculous and gummato-tuberculous ulcers of the leg are frequently benefited by strapping, bandaging, elastic stockings, etc., and when, as is sometimes the case, they tend to erysipelas-like inflammation, cold lead-water on cloths or in poultices should be temporarily employed. Finally, let me once more urge the necessity of extreme cleanliness and the removal of all crusts, scales, and discharge, before the application of local treatment of any kind.

Syphilis in its Relations to Marriage.

Physicians are not infrequently consulted by individuals who have contracted syphilis, or who believe themselves to have contracted this affection, regarding their intended marriage; and it is of great importance that the answer given should not be misleading, for the health and happiness of two persons at least may be affected by it, and the consequences of a mistake may influence an unborn generation for evil.

It will not do, on the one hand, to sternly repel such persons with the simple and categorical refusal to give medical sanction to the intended union. Sometimes this is done when the history of infection dates back to a remote past, and when no symptoms of syphilis have shown themselves for years. Now and then even the suspicion of the patient's having had syphilis is sufficient to induce his physician to forbid the banns.

The misery and immorality to which such restriction almost necessarily tends to give rise, should cause the conscientious physician to hesitate before

washing his hands lightly of the whole business by declining to sanction the marriage of a former or of a presumptive syphilitic.

On the other hand, to sanction marriage when the syphilitic disease is still active in the system, even although it does not for the moment show itself by any outward sign, is to lure an unsuspecting victim to the committal of a crime against himself and others, of which he cannot appreciate the consequences.

It therefore behooves the physician who is called upon to pronounce an opinion in such a case to examine the patient with the utmost care, to go into the history of the case, with minute examination of every point which can throw light upon the presence or course of pre-existent syphilitic disease, and not to pronounce his opinion until fully satisfied of the exact condition of his patient.

As formulated by Langlebert,[1] the various cases which present themselves may be grouped under one or another of the following heads: (1) An individual[2] previously without syphilitic disease shows one or more lesions, apparently chancroids, and asks whether he may marry, and how soon. (2) An individual having had six months or longer previously one or more venereal sores, as to the character of which he cannot speak positively, but for which mercurial treatment was followed, asks the same question as (1). (3) An individual who is or has been the subject of an infecting sore (chancre), afterwards followed by generalized symptoms, which may or may not now show themselves, asks the same question as (1). (4) A man marries after having had syphilis, but at so remotely previous a date that there is reason to hope that he will show no future signs of the disease—what has he to fear for his future offspring? (5) An individual marries, having present syphilitic manifestations, or contracts syphilis after his marriage—what shall be done to avoid, or at least to lessen as much as possible, the consequences of his misconduct?

Under the first head, when a patient displays one or more venereal sores resembling chancroids, and asks how soon he may marry, the advice should be given to wait for six months. If by the end of this time no generalized lesions have made their appearance, the marriage may be consummated without fear.[3] For, as has been shown in the earlier portion of this article, the longest period of incubation elapsing between the appearance of the initial lesion and the explosion of the general symptoms, does not exceed six months. Of course it is understood that during this period the patient should submit himself to the frequent inspection of his physician, for otherwise the earlier general symptoms may pass unnoticed. In addition, the patient should be directed to examine himself carefully from day to day, and especially to look for the erythematous rash, which so often appears and disappears without having been perceived, as well as for papules, mucous patches of the mouth, etc., crusted lesions of the scalp, and enlargement of the cervical glands.

Under the second head, where a person who has had a suspicious sore or sores six months or more previously, for which mercurial treatment has been fol-

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[1] La Syphilis dans ses Rapports avec le Mariage. Paris, 1875.

[2] Women so rarely present themselves for examination and opinion that I consider here the case of men only. There is, of course, little difference between the sexes regarding the manifestation of the disease, excepting the far greater difficulty of finding whether or no a woman has had a chancre. I fail in ninety-nine cases out of a hundred to get any history of an initial lesion on the genitalia in women, though I rarely meet with cases where there is any apparent intent or desire to deceive.

[3] Under such serious circumstances no reliance can or should be placed upon the classical descriptions of chancre and chancroid. In these cases the chancroid is the lesion which is found not to be followed by general syphilis, after six months of careful watching, and no decision can be arrived at until the expiration of this period.

lowed, asks if he may marry, an element of great uncertainty is introduced into the question by the course of treatment which the patient has undergone. For, as is known, mercury given between the appearance of the initial lesion and the advent of general symptoms, has the power to adjourn the appearance of the latter without preventing their ultimate manifestation.[1]

In these cases the physician should go very carefully into the history of the patient, and should endeavor to extricate from his answers some data upon which to base a diagnosis. Failing this, a postponement for at least three months must be enjoined, the patient remaining under observation meantime, and, of course, no treatment being employed. The following scheme gives a guide to the questions which should be asked in eliciting the history of former syphilitic disease:—

Scheme for the Examination of Persons supposed to have contracted Syphilis.[2]

(1) The individual has had venereal sores (chancres).

(2) Ascertain precisely the date at which these sores were contracted. Were there one or more? In the latter case, did they come out simultaneously or consecutively?

(3) Supposing but a single sore to have existed, what was its seat, its form, its dimensions? How long a time elapsed between the date of supposed exposure and that of the appearance of the sore? Was it soft or indurated?

(4) Examine the point indicated as having been the seat of the sore in question. Do not forget that the specific induration may last a long time after the sore has healed; that in some cases it may be noticeable even after some years. Remember also that the cicatrix of chancre, when it occurs upon the skin, as on the outside of the prepuce, may present a characteristic bronze tint, which disappears very slowly.[3]

(5) What took place in the neighboring lymphatic ganglia? Were the glands swollen at any time? If so, were there a number in the groin (supposing, of course, that the suspicious sore was on the genitalia), on one or on both sides, a hard and indolent group of nodules; or did the glandular involvement take the form of a red, painful, inflammatory tumor, having a single ganglion as its centre?

(6) In the latter case, did the ganglionic tumor suppurate, or did it terminate by resolution? If it suppurated, did the opening by which it discharged heal up promptly, or did it grow larger and itself become a virulent sore?

(7) Examine the inguinal regions, where possibly the vestiges of a specific adenopathy may still be found, persisting, as it sometimes does, for months and years after the initial lesion has disappeared.

(8) If the patient has had a suppurating bubo, the cicatrix should be recognizable, and should show by its extent whether the suppurative opening had closed quickly or whether there had been a virulent open sore. In the latter case it is almost certain that general infection has not taken place.

(9) Inquire how long the sore or sores persisted, what treatment was followed, and what physician attended the patient. The treatment of a competent physician will, of course, throw light upon the nature of the disease. (Unfortunately, too few physicians are competent to interpret any but the plainest symptoms of syphilis with certainty, while too many give anti-syphilitic treatment in all doubtful cases, of whatever nature. Too much reliance must not, therefore, be placed upon the answer to this question.)

(10) What followed the sores in question? Does the patient remember to have experienced weakness, fatigue, or pains in the head or limbs, worst at night, during the three months previous?

(11) Has the patient observed the appearance of a rash, coming out in small, reddish

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[1] This is not admitted by all syphilographers, but statistics show, I think, conclusively, that the view here taken is correct.

[2] This scheme is founded on the one given by Langlebert, in his work already quoted.

[3] See Léon Montaz, Recherches sur la Trace Indélébile du Chancre Syphilitique, ses Caractères. Paris, 1880.

patches, or round, red, flat, lentil-sized pimples, over the chest, abdomen, and forearms, unaccompanied by any sensation?

(12) Has the patient had, about the same time or a little later, certain grayish patches, with or without ulceration in the throat, on the lips, or on the tongue? (I find patients call these either simply " sores" or " fever-blisters," " cankers," or " ulcerated sore throat;" they are among the most constant symptoms noted and remembered by patients when questioned as to their previous history.) Has the hair thinned or fallen out? Have there been any lentil-sized blackish crusts in the scalp at different points? Have the mastoid or cervical lymphatic ganglia been enlarged at any time, or are they now?

(13) Examine by palpation the occipital region, where there may possibly still be found some ganglionic enlargement; these enlarged glands sometimes persist long after the disappearance of other syphilitic symptoms.

(14) Examine the hair of the scalp: observe if this is thin, especially in the occipital and temporal regions; if it preserves its natural suppleness, or if it has become dry and harsh; also see if there are any cicatrices, or small white patches, deprived of hair, here and there.

(15) Examine the throat. If the tonsils and velum palati have been the seat of ulcerated mucous patches—a symptom rarely lacking in early generalized syphilis—the indelible vestige of these lesions can generally be recognized. The mucous membrane, instead of being smooth as it ordinarily is, presents an irregular surface of a rugous and shagreen-like appearance; the edges of the velum and half arches have lost the sharpness of their contour; they are rough and irregular, with more or less deep indentations. This symptom has only a relative value, since cauterization for any other affection of the fauces will produce the same effect. It should have weight as corroborative evidence, however, when it is present.

(16) It should be remembered that with many persons who have had syphilitic symptoms, even long previously, the lips, the buccal mucous membrane, and particularly the edges and point of the tongue, show small whitish patches of a roundish or irregular contour. These patches are very persistent, and when present furnish very strong presumptive evidence of former syphilis.

(17) Examine the body, and particularly the back, shoulders, and legs, to see if there are not some cicatrices of former pustules. The scars are usually rounded, reticulated, and sharply circumscribed, this feature serving to distinguish them from burns; the latter are always more or less irregular. (Furuncles and acne pustules often have cicatrices quite undistinguishable from those of syphilis; the latter are very common over the back and shoulders, but are rarely found on the arms or legs.) The chest, the abdominal region, the lower limbs, the palms of the hands, and the soles of the feet may likewise present some spots or macules, with or without a depressed surface, their yellowish or coppery tint showing their age to a certain extent, being darker the more recently the lesions have existed.

(18) The patches of tinea versicolor found on the trunk are sometimes taken for the erythematous syphiloderm, but a moment's inquiry will show them to have lasted months or years, while the syphiloderm is acute and comparatively transient. The same may be said of the pigmented macules left after acne in dark-skinned persons. These will be found on inquiry to be connected with lesions often dating back to puberty.

As to the third question, whether an individual who has had chancre, followed by subsequent generalized symptoms, may marry; of course, the answer must be negative if the symptoms are still manifest. But if they have disappeared months or years ago, then the question becomes more difficult to answer, and the first problem to resolve is this: is syphilis curable? Without going into that question from a general point of view, I do not hesitate to say that for our present purpose syphilis is curable.

Whether, however, any given case can be said definitely to be cured at a stated time, is a different question. And yet some such statement must be made if the patient is to be authorized to marry.

Mild cases of syphilis, when the early symptoms follow one another at a normal interval and in a benign form, are not apt to relapse. The disease

may be said in these cases to run a definite course, and to exhaust itself in the course of perhaps eighteen months or so, on an average, under judicious treatment. Now and then some slight localized eruption may appear subsequently, but in a majority of cases no lesions which can be called contagious make their appearance. While it is true that mild early symptoms do not insure the patient against the occurrence of late visceral lesions, yet a case of benign syphilis which has been carefully treated is not one where wife or children are apt to suffer if the patient allows a sufficient time to elapse after the appearance of the last lesions, before marrying. In the few cases of this kind which I have had under complete control from the beginning, I have permitted marriage after eighteen months of treatment, followed by from six months to a year of immunity, and I have followed up the history of several persons thus permitted to marry, and have known them to procreate healthy children.

But even benign syphilis, if not treated at an early period, and thoroughly, tends to relapse, and I should not be inclined to authorize marriage in a patient, particularly a woman, who had taken mercury irregularly, and who had suffered a number of relapses. Such cases are those in which healthy and diseased children are procreated alternately for a series of years, as the patient may or may not be under the influence of mercury at the time of conception.

But in cases of more severe syphilis, where the earlier symptoms are pustular instead of erythematous, where the disease is stubborn to the influence of mercury, and where there is a tendency to relapse and to ulceration, I should be inclined to prolong the treatment very considerably, not permitting the patient to marry until eighteen months or two years after the disappearance of all outward signs of disease, and the cessation of a mercurial course which had also lasted for at least eighteen months or two years, making about four years in all. This practically amounts almost to a prohibition, but if the physician is not firm in these cases, he may have cause to bitterly regret his complaisance at a subsequent date. Patients will marry, if they decide to do so, in spite of the doctor's warning; but it is a thousand times better to risk the reputation of over-cautiousness, than to have a diseased being brought into the world, which has been begotten under the sanction of the physician.

Regarding the fourth proposition, which is closely connected with that just discussed, the question here is pushed farther, and it is desired to know what injury can occur to the children of a parent who has had syphilis long before his marriage, who presents no signs of the disease afterwards, and whose offspring in consequence cannot be expected to show any of the symptoms of syphilis in its ordinary form. Can the syphilitic taint so influence such offspring as to induce rickets, scrofula, and the like? In answer to this question I should say that not only is it contrary to all our experience that one disease should give rise to another entirely distinct from it, but that in spite of the fascination which this theory of scrofula as a derivative of syphilis has exercised over the minds of able observers, it has never been possible to bring forward a sufficient number of cases in proof of the theory to convince those who had not previously made up their minds on the subject. No, as has been said in the earlier part of this article, syphilis is a distinct entity, and can beget syphilis alone. It may appear alongside of scrofula, and may run a parallel course with that affection. It may predispose by its cachectic influence to the development of the so-called scrofulous maladies, or the scrofulous taint may cause the subject to suffer the severer ravages of syphilis. But as for a combination such has been fancied, analogous to that between two chemical elements (e. g. the "scrofulate of syphilis," of Devergie), this has never been shown to exist.

So far from syphilis gradually tapering off into scrofula, it is in reality cut short and extinguished. Many children and adults are alive and in blooming health at this day, one or even both of whose parents were the subjects at one time of syphilis.

In the case of an individual who marries with symptoms of syphilitic disease already manifest upon his person, or who contracts syphilis during married life, the considerations which present themselves are different from those which have thus far been discussed. The question here is to prevent the transmission of the disease to other members of the family, and chiefly to the husband or wife, as the case may be.

When a man has a genital chancre, he seldom knowingly exposes his wife to contagion, and of course it is necessary to avoid sexual intercourse entirely at such a time. While the physician, consulted by such a person, should positively interdict all commerce of the kind, he should, at the same time, when circumstances permit, adopt either such treatment as frequent coating of the lesion with collodion or light cauterizations with nitrate of silver, or the application of some such remedy as may suggest itself to prevent the possibility of coitus. For the married man who places himself in a position to contract syphilis, is not a person of such nice sensibility as to balk at the prospect of infecting his wife when his own selfish indulgence is in question. If we can persuade him that some injury to himself may possibly accrue, we may be able to arouse him to caution and self-denial; but I have found it unsafe to appeal to any but selfish motives in such cases.

The danger from chancre past, the next, and in practice indeed the commonest danger, is from mucous patches about the mouth and lips. The married man who has suffered with chancre should examine his mouth and fauces daily during many months, in order to detect the first appearance of these extremely common lesions. When present, they should be cauterized lightly every day with nitrate of silver, with the view of coating their surface and rendering them less virulent, and at the same time the patient must be warned against kissing any one of the family, and against permitting the use after him of such utensils as spoons, cups, etc., by other persons, without previous cleansing.

Should the wife of such a person by chance become pregnant, she should undergo a course of mercurial treatment to prevent the development of syphilis in the foetus. The earlier and more thorough the treatment of the mother, the more likely will she be to bring forth a healthy child.[1]

Legal Measures to prevent the Spread of Syphilis.

The continuance and generally increased diffusion of syphilis have attracted the attention of the medical profession more and more to the necessity of employing some means of arresting the spread of the disease. The measures proposed have been: (1) that of Auzias Turenne,[2] who conceived the idea that syphilis might be inoculated in the same manner as smallpox was inoculated before the discovery of vaccination, and thus immunity gained in case of subsequent exposure. (2) The supervision and examination of prostitutes

[1] For a careful examination and treatment of this subject, reference may be made to the following works :—
Langlebert, La Syphilis dans ses rapports avec le Mariage. Paris, 1873.
Diday, Le Péril Vénérien dans les Familles. Paris, 1881.
Fournier, Syphilis et Mariage. Paris, 1880. A translation of this work into English has lately appeared.
[2] De la Syphilisation, ou Vaccination Syphilitique (Arch. Gén. de Méd., 4e Sér. t. xxxvi., 1851).

with the view of arresting the spread of the disease, at least at one of its sources.

The first method of prophylaxis has proved a failure, because the disease contracted by syphilization is precisely the same as that gained in other ways, both in character and degree. The second has been tried in various localities with varying results, but with as yet no decided advantage to the community at large, except in the case of some garrison towns in England, where a decided lessening of syphilis has been the result.

The question of the regulation of prostitution must inevitably be discussed in connection with that of the prevention of syphilis, and here of necessity the moralist must be interested as well as the physician. If prostitution could but be looked at from a purely medical standpoint, and only in its relation to the production of syphilitic disease, the matter would be greatly simplified. As it cannot be so in the present state of human nature, and as the moralist and theologian consider it as much within their province as that of the physician, the problem is much complicated, and must, I think, in the end, be solved by taking into consideration both points of view. Unfortunately there has been a controversy here upon points on which no controversy as it appears to me is necessary, and both sides have dealt largely in vituperation where cold facts alone are required or can be at all convincing. Almost every contribution to the subject has been made with the view of proving a pre-supposed theory, rather than of indifferently recording facts no matter what conclusions may be drawn from them.

For this reason I consider that the time has not yet come to advocate the regulation of prostitution, at least in our American cities, where the municipal government, already notoriously inefficient, would certainly be unable to devise a satisfactory method of coping with the evil, and where a breakdown in the administration of the law would be worse than having no law at all.[1]

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[1] The following works and papers, chiefly of a statistical character, may be referred to as giving information especially with regard to the prevention of syphilis in European countries :—

Lecour, C. J., De la Prostitution et des measures de police dont elle est l'objet à Paris, etc. (Arch. Gén. de Méd., t. ii. p. 711 et 736, 1867).

Id., La Prostitution à Paris et à Londres de 1789 à 1870. Paris, 1870.

Crocq et Rollet, Prophylaxie Internationale des Maladies Vénériennes (Ann. de Derm. et de Syph., t. i. p. 353, 1869).

Cambas, De la Prophylaxie de la Syphilis (El Siglo Med. Translated in Annales de Derm. et de Syph., t. iii., 1871–72).

Nevins, J. B., Protection from Venereal Diseases in America (Sanitarian, vol. viii. p. 252).

——— Hong-Kong, 1878 (contagious diseases ordinance). Return to an address of the House of Commons, Feb. 13, 1880, for copy of report of the Commissioners to inquire into the workings of the Contagious Diseases Ordinance, 1867 (ordered by the House of Commons to be printed, March 11, 1880). London, 1880.

Thomson, W., Some Results of the Contagious Disease Acts (Med. Press and Circ., N. S., vol. xxxii., 1879, p. 341).

Gihon, A. L., Report of the Committee on the Prevention of Venereal Disease, presented at the eighth annual meeting of the American Public Health Association. New Orleans, 1880.

Sturgis, F. R., Relations of Syphilis to the Public Health. New York, 1877.

Sims, J. Marion, Legislation and Contagious Diseases. Phila., 1876.

Vintras, A., On the repressive measures adopted in Paris, compared with the uncontrolled prostitution of London and New York. London, 1867.

Henry, M. H., Discussion on the Prevention of Syphilis at the Int. Med. Congress at Vienna, 1873, with remarks (Am. Jour. Syph. and Derm., vol. v., 1874, p. 17).

Swayze, G. H., Shall the spread of Syphilitic Poison be prevented ? (Phila. Med. and Surg. Reporter, Oct. 6, 1877).

——— The Regulation of Prostitution as a Sanitary Measure (Editorial, Med. Record, vol. xvi., 1879, p. 205).

White, J. Wm., The Prevention of Syphilis : an address prepared at the request of the Philadelphia County Medical Society, and read before it Dec. 14, 1881 (Phila. Medical Times, Jan. 14, 1882). This last is an especially able review of the entire subject from a point of view favorable to the regulation of prostitution.

VENEREAL DISEASES:

BUBON D'EMBLÉE, VENEREAL WARTS OR VEGETATIONS, PSEUDO-VENEREAL AFFECTIONS, VENEREAL DISEASES IN THE LOWER ANIMALS.

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BUBON D'EMBLÉE.

BUBON D'EMBLÉE, "or bubo at the first onset" (*Primary Bubo*), is a name applied to an inflammation of the glands of the groin, occurring after sexual intercourse, and apparently not depending upon any lesion of the genitals— the theory of those writers who introduced the term being that the peculiar virus of the chancre or chancroid might enter the lymphatic vessels of the skin or mucous membrane, and be conveyed to the nearest group of glands, there to excite its characteristic inflammation, without producing any lesion of the tissues at its point of entrance. This manner of origin was considered possible by many of the older writers upon Venereal Diseases, among whom may be mentioned, John Hunter, Vidal (de Cassis), Gibert, and Castelnau— the latter authority reporting several cases of the so-called *bubon d'emblée*, in regard to all of which, however, there is ground for doubt, either the examination of the genitals having been incomplete, or deferred too long, or the antecedents of the patient not having been sufficiently inquired into.

Ricord[1] believes that the theory of the *bubon d'emblée* is unfounded, and Cullerier[2] declares that the bubo which has received this name is nothing but a simple adenitis, such as may result from over-exertion or fatigue incurred in any manner whatever.

Ch. Mauriac,[3] in an exhaustive study of this subject recently published, in which he has carefully studied many cases of the so-called *bubon d'emblée* occurring under his own observation, states that not one case is complete or unassailable, and that the existence of the chancroidal and of the syphilitic *bubon d'emblée* cannot be admitted. Berkeley Hill[4] declares that the *bubon d'emblée* is not followed by syphilitic eruptions; that the pus of this bubo is not of the nature of the pus of the virulent [chancroidal] bubo; but that it often follows coitus, and is generally seen in persons of that constitutional

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[1] Ricord and Hunter on Venereal Diseases, p. 341.
[2] Précis Iconographique des Maladies Vénériennes, p. 304.
[3] Étude sur le Bubon d'Emblée. Paris, 1880.
[4] On Syphilis and Local Contagious Disorders, p. 356.

diathesis which predisposes to glandular inflammations from other causes. Follin, like Cullerier, suggests that the *bubon d'emblée* is independent of contagion, and is simply due to the fatigue of violent intercourse.

An examination of the literature of this subject will, I think, convince any one that the existence of the *bubon d'emblée*, in the original acceptation of the term, cannot now be acknowledged, for none of the reported cases are free from the chance of error; in no case does constitutional syphilis start from this lesion, and the results of inoculation of its pus are negative. What, therefore, is called the *bubon d'emblée* must be considered as either a simple adenitis, due to irritation; an inflammation of the glands due to pre-existence of a chancre or chancroid which has escaped observation, or which has healed before the glandular affection has become marked; or a gummatous affection of the glands occurring during the course of syphilis.

Dr. Sturgis reports a case of the latter affection which closely resembles many of the recorded examples of *bubon d'emblée*, and I have myself had a case under observation in which symmetrical buboes occurred without apparent cause, in a patient who had been for some time suffering from constitutional syphilis, and in whom the inguinal affection rapidly disappeared under constitutional treatment. Mauriac[1] reports three cases of gummatous inflammation of the inguinal glands, and Verneuil[2] has observed several cases of the same nature.

TREATMENT.—The treatment of the so-called *bubon d'emblée* consists, first, in putting the patient at rest, and then making counter-irritation around the inflamed area with tincture of iodine, after the manner of Mr. Jordan, applying the drug not over the affected part, but over the "next vascular area;" poultices may also be applied, and, if the inflammation goes on to suppuration, a free incision should be made as soon as the presence of pus can be detected. From the fact that these buboes frequently occur in persons of strumous or debilitated constitutions, tonics are indicated, and of these, cod-liver oil and iron are to be preferred; the use of iodide of iron, either in the form of the syrup or of the officinal pill, is often followed by the most satisfactory results.

In cases which point to a gummatous inflammation of the glands of the groin, the administration of the iodide of potassium will generally effect a rapid cure, and preclude the necessity of any operative interference.

VENEREAL WARTS OR VEGETATIONS.

VENEREAL WARTS or VEGETATIONS are highly vascular, papillary growths, springing from the mucous membrane or the skin; they occur most frequently on the genital organs, and are identical in their nature with warts seen in other parts of the body. "They are exceedingly vascular, and are made up of connective tissue elements, which make a mass of firm consistence; the papillæ are much hypertrophied, and are covered with an extensive mucous layer; the horny layer may be found developed in warts in certain localities."[3]

NATURE OF VEGETATIONS.—The term "venereal" is not, strictly speaking, correct, as these growths are sometimes seen in children, in pregnant women free from venereal taint, and in persons who have never had sexual intercourse, seeming, in these cases, to arise from the irritation produced by the

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[1] Gazette des Hôpitaux, 1879.   [2] Hill, op. cit., p. 203.
[3] Duhring, Diseases of the Skin, p. 467.

Vegetations of Vulva and Penis.

decomposition of the natural secretions of the parts; but, on the other hand, it must be acknowledged that the irritating discharges arising from venereal diseases are a frequent cause of their production. The occasional occurrence of these vegetations in the lower animals also furnishes additional evidence of their not necessarily being of venereal origin.

The special susceptibility of the mucous membranes and skin of certain persons to the production of warts, has been attributed to constitutional peculiarity or inherited predisposition, and by Martin to the presence of a "lymphatic diathesis." Diday,[1] from an investigation of fifty-five cases of warts upon the genital organs, found that, in forty-seven cases, the patients had suffered during childhood from warts occurring elsewhere.

The favorite seats for the production of these growths in the male are, the internal surface of the prepuce, the furrow behind the corona glandis, the glans penis itself, and the edge of, or just within, the meatus; in the female, they appear on the labia, the vagina, and about the anus. Heat and moisture—conditions which exist in the above-named localities—are elements favorable for the development of vegetations. The condition of phimosis acts as a predisposing cause in the production of these growths, the concealed condition of the parts rendering the removal of the natural secretions, or of the discharges due to venereal disease, difficult or impossible.

APPEARANCE OF VENEREAL WARTS.—When situated upon the genitals, warts are generally attended with a whitish or yellowish discharge, due to the irritation caused by friction, or to positive ulceration; from the heat of the parts, the discharge undergoes decomposition, and gives rise to a peculiarly offensive odor. In shape and size the growths may present great variety, this depending much on their location; on the glans penis, and on the inner surface of the prepuce (Plate XV. Fig. 1), they may occur as elevated masses, granular in appearance, and either sessile or pedunculated; or they may exist singly, as slightly flattened cones. When they occur on the skin of the prepuce or on the body of the penis, they are apt to be conical in shape, and to show a predominance of the horny layer; in the neighborhood of the anus they may occur as elevated masses, flattened by pressure (Fig. 341); and in the female genitalia they are frequently seen as large masses, resembling cauliflower excrescences (Plate XV. Fig. 2). The extent to which these growths may invade certain localities is only limited by the area of surface favorable for their production; the anus and vulva may be completely surrounded; the vagina may be almost occluded; and the configuration of the glans penis and prepuce may be entirely masked.

Fig. 341.

Vegetations around anus in a child.

CAUSES OF VEGETATIONS; QUESTION OF CONTAGION.—These growths are more common in women than in men; the large extent of mucous surface liable to be irritated by the secretions

[1] Diday, Thérapeutique des Maladies Vénériennes, p. 346, 1876.

disordered through venery, or by the unhealthy discharges from the parts, offering a fruitful soil for their production. The existence of pregnancy also favors the production of warts, probably on account of the engorged state of the genital mucous membrane, dependent on the pelvic congestion normally seen in this condition; under these circumstances, the growth of vegetations may be so rapid and extensive as entirely to fill up the vaginal canal. The occasional presence of these growths on mucous patches has caused some authorities to consider them as syphilitic in nature; but their coexistence seems rather accidental than otherwise, and that they are not due to syphilitic contamination is shown by the fact that they are cured by local treatment only, and are not affected by constitutional remedies.

As regards the *contagiousness* of these growths, much difference of opinion exists, some authorities considering them eminently contagious, while others believe them incapable of being transmitted in this way. In many instances they certainly seem to be communicated by direct contact, as in a case recently brought under my notice, in which four young men had each a profuse development of vegetations, after intercourse with the same woman, who was herself suffering from warts at the time. Whether, however, in such cases, the growths are caused by direct contact with the growths existing in the woman, or by exposure to the irritating vaginal discharge which itself produced the original crop, is a question which cannot be definitely settled; but, on the whole, the weight of evidence favors the former view, and it is probable that, as believed by Bumstead, the contagious property resides in the secretions from the warts themselves.

TREATMENT OF VEGETATIONS.—The removal of venereal warts may be effected in various ways, either by excision, by the use of caustics, or the cautery, by ligation, or by the application of astringent or desiccating powders. *Ligation* is a tedious method, and is now seldom employed.

Excision, one of the most popular methods, is accomplished by shaving or snipping off the growths with knife or scissors, the cut surface being then touched with some caustic or astringent; this method has the disadvantage of being followed, in some cases, by profuse hemorrhage, which, if the growths removed have been extensive, may be difficult to control.

The actual cautery may also be applied for the removal of these growths, either in the form of the hot iron, or the hot loop of the galvano-cautery, or in the form of Paquelin's cautery; it presents a method of treatment which is both efficient, and at the same time free from the risk of troublesome hemorrhage.

Caustics and Astringents.—In other cases the growths may be simply touched with nitric acid, chromic acid, or the liq. plumbi subacetatis, or, when small, may be dusted with calomel, tannic acid and lycopodium, or dried alum. The use of chromic acid has been highly recommended by Mr. Fromer,[1] Mr. Marshall,[2] and Dr. Crawcour,[3] and is, by Prof. Ashhurst, preferred to any other mode of treatment; it is in many cases followed by the most satisfactory results. Both Dr. Keyes and Dr. Bumstead recommend a preparation consisting of corrosive sublimate, $\mathrecommendj$, with collodion, f$\mathrecommendj$, to be painted on the growths; they consider this a particularly efficacious remedy in the dry form of the disease.

Treated by any of these means, warts will sometimes recur, in which case the same procedure should be repeated. Keeping the parts clean, and as dry

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[1] Dublin Journal of Medical Science, vol. xiii. p. 250.
[2] Ranking's Half-Yearly Abstract, vol. xxv. p. 183.
[3] New Orleans Medical News, Nov. 1857.

as possible, after the growths have been destroyed, is an important adjuvant in effecting a permanent cure.

The large growths which occur during pregnancy should not be subjected to operative interference; the treatment here should be palliative, consisting in keeping the parts clean by the use of a disinfectant lotion, such as Labarraque's solution, since a spontaneous cure may take place after delivery; if, however, the growths persist, they may be dealt with at the proper time, as in other cases.

The treatment of warts, when complicated with phimosis, generally requires operative interference, either by splitting the prepuce, or by a formal circumcision, so as to afford the necessary exposure of the growths; when made accessible by either of these methods, the warts can be excised, or touched with caustics or astringents in the way already described. Circumcision has the advantage of leaving the parts in a condition less favorable for the reproduction of the disease.

Pseudo-Venereal Affections.

Under this name may be included several diseases which are transmissible by contact, and, therefore, by sexual intercourse when the generative organs happen to be affected, but which have no necessary or even habitual dependence upon such intercourse, and are not, therefore, strictly entitled to be called venereal. Some of the affections to be described under this head are, however, probably really identical with syphilis.

Yaws. (Synonyms: *Framboesia, Pian.*)—These names have been given to an affection which is endemic among the negroes on the west coast of Africa, and which has from that locality been transported by slave traders to the West Indies, and to the Southern States of America. This disease was described by the Arabian physicians as early as the tenth century, and from them received the name of Sahafti.[1] According to Lancereaux,[2] it is met with as an endemic disease from the left bank of the Senegal River to Cape Negro, in Senegambia, Congo, Sierra Leone, and Nigritia, and in the colonies which have drawn their slave supply from those regions. Milroy[3] believes that the geographical distribution of the disease is much wider than is generally supposed, and that it occurs not only on the west coast of Africa, but in the islands of the Pacific, in South America, in the Melanesian Islands, and on the east coast of Africa.

Symptoms.—The symptoms of yaws, according to most authorities, are lassitude, malaise, more or less fever, pain in the joints, and a papular eruption which goes through various phases of development, and which in certain stages, from its resemblance to the wild raspberry, has caused the disease to receive the name "framboesia." At a later period the patient suffers from ulcerations, osteocopic pains, and various affections of the bones—exostoses, necrosis, and caries—and in rare cases from gangrene. Imray[4] declares that little constitutional disturbance is manifested at the outset of the disease, and that it is not until the affection has existed for some time that the general health suffers, when the patient becomes emaciated and debilitated from the attending pain and ulceration.

[1] Theodoric, lib. viii. cap. xviii.
[2] Lancereaux, Treatise on Syphilis (New Sydenham Society's Translation), vol. i. p. 31.
[3] Medical Times and Gazette, June, 1880.
[4] Tilbury Fox, Diseases of the Skin in Hot Climates, p. 467.

"The eruption," according to Duhring,[1] "consists of variously sized papules, tubercles, and tumors, which are present in all stages of development; they begin in pin-head sized points, which enlarge until they become the size of split peas, resembling in appearance currants and raspberries; as they grow they incline to become flat on their summits, and become studded with yellowish points. In time they may become as large as cherries, become softer, are apt to break down and ulcerate, discharging a thin, fetid, yellowish fluid. These lesions may be round or semi-globular, or may coalesce, forming patches of a vegetating or fungoid nature."

Mr. Hutchinson,[2] in describing a case of yaws which occurred under his own observation, says that the eruption consists of small red tubercles, present in various stages of development; when they first appear, they are small red pimples, afterwards shining red vesicles, and, when more fully developed, round elevations with flat tops, of a bright pink color, glassy, and semi-transparent, but possessing more the consistence of raspberries than of currants. The substance of the tubercles is solid, they do not collapse when pricked, but blood or bloody serum oozes from them when their surface is broken. Some become pustular, and others, when fully developed, ulcerate at their bases and drop off; their bases are not surrounded by an areola of redness.

Dr. Imray[3] says that if yaws are observed as they first make their appearance on the surface, one or more whitish or yellowish spots will be perceived, not larger than a pin's head; these spots are seen very distinctly on the dark skin of the negro. Gradually the spots enlarge and begin to project from the surface, retaining for the most part their circular form, and having much the appearance of small globules of yellow pus. The skin remains unbroken until the yaws attain the size of small peas, when a spongy yellow surface, from which a thin fluid oozes, presents itself, and this spongy body continues to enlarge until it projects considerably from the surface. The most common seats of the eruption are on the face, neck, genitals, perineum, and anus; upon the vulva and upon the lips, the eruption may be so profuse as to form a complete ring around the orifices. The lesions show no regularity of distribution, and are neither painful nor itching. When, however, the fungous excrescences appear on the soles of the feet, where they are prevented from rising by the thick epidermis, they cause those parts to become painful and swollen, and thereby offer a great impediment to walking. In this situation they are called by the natives of the West Indies *tubbæ*, or crab yaws; the case observed by Mr. Hutchinson presented this lesion. When the eruption disappears without ulceration, dark spots are left which gradually fade away, but when there has been much ulceration deep scars are produced which are permanent.

The disease is acquired by direct contact with those suffering from yaws, or by means of eating or drinking utensils, etc. From the almost constant presence of the eruption on the genitals, coitus is a frequent means of its transmission. In the West Indies, it is said also to be produced by the bite of a large fly, which, from its supposed agency in producing the disease, has received the name "yaw fly."

The period of incubation of the disease is from three to ten weeks, and its duration is from nine to thirteen months; one attack is believed to protect the patient against further invasions, although on this point as well as on that of hereditary transmission, it must be acknowledged that there is some difference of opinion among various observers.

Imray[4] considers yaws a contagious, but not an infectious disease, and be-

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[1] Treatise on Diseases of the Skin, p. 467.
[2] Descriptive Catalogue of the New Sydenham Society's Atlas of Portraits of Diseases of the Skin, p. 148.
[3] Fox, op. cit., p. 468   [4] Fox, op. cit.

lieves that it can only be communicated by contact of the sound with the diseased, or by the application of the discharges of those suffering from yaws to an abraded surface or wound. John Hunter[1] regarded this affection as contagious, and cited the case of a physician who was inoculated with yaws from a wound received while operating on a patient suffering from the disease. Thomson[2] believed yaws to be freely communicable by inoculation, and gave examples from his own practice of women being inoculated by suckling children who were suffering from it; he also inoculated children with yaw matter to ascertain if the disease could be modified by this procedure, but his results showed that the artificial production of yaws neither shortened its duration nor diminished its severity. These experiments of Thomson were confirmed by an observation of Paulet,[3] who inoculated a child with the matter taken from the pustules of yaws; the operation was followed in three weeks by an attack of the disease which lasted for nine months. Bowerbank[4] acknowledges only the contagiousness of yaws by direct contact of the secretion with a wound or abraded surface, and says that in Jamaica patients with yaws are admitted into the general hospitals without the disease being communicated to the other patients or to the attendants.

From the fact that yaws is frequently contracted during sexual intercourse, from its peculiar manifestations on the skin and mucous membranes, and from the fact that it is often followed by sequelæ much resembling those of syphilis, it is not surprising that the older writers considered it to be identical with that disease. Indeed, John Hunter[5] stood almost alone among the surgeons of his time in maintaining that yaws was a distinct and separate affection. Nor can it be said that the more modern writers are unanimous in their opinions upon this point; Lancereaux[6] and Berkeley Hill[7] consider the identity of the two diseases well established, and adduce the fact that they are both amenable to mercurial treatment as furnishing additional evidence in support of their view. Milroy,[8] Bowerbank, and Imray, on the other hand, while they acknowledge certain points of resemblance with syphilis, believe yaws to be a distinct and separate disease.

I think that the weight of authority and the evidence of recent observers certainly point to the non-identity of the two affections, a view which is sustained also by the fact that both diseases can exist in the same patient at the same time; Milroy mentions a case where yaw-ulcers and syphilis existed simultaneously, and Dr. Ross also cites a case of syphilis and yaws being found in the same patient, the syphilis getting well under mercurial treatment, while the yaws remained.

Treatment of Yaws.—Thomson says that the natives of the West Indies looked upon this disease with peculiar disgust, and that patients suffering from yaws were isolated on remote parts of the estates, receiving little care except from negro attendants, and being seldom brought to the notice of European physicians. The natives employed in the treatment of this disease the flowers of sulphur, dusted on the ulcerated parts, and the contused leaves of the physic-nut (jatropha curcas), and the juice of the bitter cassava (janipha manihot).

The treatment of yaws, according to Imray, consists in the use of baths to encourage the full development of the eruption, and in the exhibition of sulphur and of the bitartrate of potassium, for the first six or eight days. Mercury is then given, with decoction of sarsaparilla or sassafras, but

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[1] Works, vol. ii. p. 471.
[2] Edinburgh Med. and Surg. Jour., vols. xv.–xviii.
[3] Lancereaux, op. cit., vol. i. p. 33.
[4] Medical Times and Gazette, June, 1880.
[5] Op. cit.
[6] Op. cit., p. 33.
[7] Op. cit., p. 15.
[8] Leprosy and Yaws in the West Indies, 1873.

it is stopped as soon as the gums begin to show the slightest evidence of its constitutional action. Tonics should be given to persons of enfeebled constitution in conjunction with the mercury. The patient should be allowed a generous diet, and the greatest attention should be paid to cleanliness, upon which indeed Thomson, who disapproved of the mercurial treatment, depended almost exclusively. Locally, a weak ointment of the acid nitrate of mercury, or a solution of carbolic acid, may be used with benefit; the latter remedy Dr. Murray[1] has also administered internally with good results. Bowerbank speaks well of the mercurial treatment as shortening the course of the affection, but thinks that the disease is more apt to be followed by sequelæ when it is used; he also says that the iodide of potassium is efficacious in certain cases, especially those in which the mucous membranes are involved.

PARANGI.—Mr. Kynsey[2] describes a disease which has existed for many years in Ceylon, and to which the name of Parangi is given. It presents a stage of *incubation* in which a sore is found on some part of the body, and which is followed by a stage of *invasion*, characterized by the development of slight fever and dull pain in the joints. The *eruptive* stage follows this, and lasts for several weeks or months, ending either in convalescence or in the development of certain sequelæ, among which may be mentioned ulcers, by which the eruption may be succeeded. The affection is contagious, through the secretions from the eruption or ulcers coming in contact with an abraded surface, or even with the healthy skin, and it is also supposed to be capable of hereditary transmission; one attack seems to confer immunity from others. Mr. Kynsey points out the similarity of this disease, in its clinical history, to syphilis; but believes it to be allied to, if not identical with, yaws. The Parangi disease of Ceylon is also described by Tilbury Fox.[3]

VERRUGAS.—Under the name Verrugas, Dr. Ward,[4] of Peru, describes a disease existing in that country, which bears some resemblance to yaws; it is usually preceded by an initial fever, lasting from ten to thirty days, and is accompanied by excruciating pain of a rheumatic character, finally culminating in an eruption of warty growths upon the body; these occasionally proceed to suppuration or ulceration. By reference to Dr. Ward's article it will be seen that this affection lacks many of the symptoms and characteristic features of yaws, of which disease Dr. Duhring nevertheless considers it a variety, as he does a somewhat similar affection which occurs in the valley of the Amazon.

SIBBENS OR SIVVENS.—This is a disease peculiar to the west coast of Scotland, occurring in the districts of Galloway, Dumfriesshire, Ayr, etc. It was first described in the seventeenth century, and was supposed to have been introduced by the troops of Charles the Second; the disease is now almost if not entirely extinct.

Gilchrist[5] describes the disease as beginning with a sore throat or inflammation of the palate, the tonsils being covered with white sloughs, or ulcerated. In other cases there are elevated patches of a red or whitish color, resembling the eruption of yaws; this resemblance is pointed out by Berkeley Hill, who does not consider sibbens entitled to be regarded as a distinct

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[1] Milroy, op. cit.   [2] Report on the "Parangi Disease" of Ceylon, 1881.
[3] Skin Diseases of India, p. 95, 1876.
[4] Trans. of Internat. Med. Congress, Philadelphia, 1876.
[5] Craigie, Practice of Physic, vol. i. p. 682.

affection. Wills[1] speaks of the disease as originating in the form of condylomata or tubercles, which may ulcerate; the latter manifestations of the disease are confined to the skin and bones. Skae[2] reports an epidemic of condylomata under his own observation, which he considered identical with sibbens; it was characterized by the appearance of whitish or yellowish elevated patches on the mucous membranes of the mouth, genitals, and anus.

The most frequent seats of the eruption of sibbens seem to have been the tongue, palate, lips, cheeks, and genital organs. The disease was contagious, and was communicated by coitus, or by using the same eating and drinking utensils. Some authorities have considered this disease to be identical with syphilis; among these may be mentioned Adams,[3] Berkeley Hill, Lancereaux, and Hill[4] of Dumfries. On the other hand, Skae and Gilchrist believed it to be a distinct affection.

The *treatment* of sibbens consisted in the exhibition of mercury, and in the application of astringents to the condylomata and ulcers.

RADESYGE OR RADZYGE is a disease occurring on the sea-coast districts of Norway, Sweden, Iceland, and Greenland, and first noticed about the year 1710.

" It is a disease beginning with fever and catarrhal symptoms, more or less violent, and terminating in the eruption of papules and tubercles on the skin, and patches on the mucous membrane of the nose and throat; these may go on to ulceration ; the patient may suffer from wandering pains in the joints resembling rheumatism, which are aggravated at night."[5]

Charlton[6] describes radesyge as a disease chiefly characterized by ulcerations of the nose, mouth, and fauces, which considerably resemble the ulcerations of syphilis. The palate and nasal bones are in some cases destroyed.

The patients complain of burning pain, and perspire freely; hectic and colliquative diarrhœa set in, and frequently cause a fatal termination of the case.

The disease is said to be contagious through the perspiration, saliva, and discharges from the sores. The cold, damp, and inclement weather of the districts where it prevails, the poor quality of the food, consisting principally of oily fishes, and the imperfect ventilation of the dwellings, are important elements in its production and spread. Hubener,[7] Hünfeld, Struve, Craigie, and Lancereaux believe that this disease is identical with syphilis, and mention the affections of the mucous membrane, mouth, skin, and bones in confirmation of their opinion; Charlton, on the other hand, considers it a distinct affection. Some authorities are disposed to consider it a form of leprosy.

Treatment.—Struve[8] speaks highly of the employment of corrosive sublimate combined with sarsaparilla or sassafras, and believes that cleanliness, good food, and the use of flannel clothing, are important elements in the cure of the disease; as a local application to the ulcers, he recommends corrosive sublimate and lime-water, or yellow wash.

SCHERLIEVO OR FIUME.—This was an endemic disease which existed on the coasts of Illyria, Dalmatia, and Croatia, during the last century. The disease

[1] Edinburgh Med. Journ., 1844, page 282.　　[2] Skae, Ibid. p. 615.
[3] Observations on Morbid Poisons, London, 1807.
[4] Cases in Surgery, Edinburgh, 1772.
[5] Craigie, Practice of Physic, vol. i. p. 690.
[6] Edinburgh Med. Journ., vol. xlviii. p. 101.
[7] Ibid.　　[8] Craigie, op. cit., p. 696.

attacked the face and skin generally, in the form of malignant pustules, which were followed by ulceration and by caries of the bones.[1] It was described by MM. Percy and Laurent[2] as commencing with lassitude and pains in the bones, which increased at night; the voice became hoarse, deglutition was difficult, the uvula, tongue and pharynx became red and aphthous; ulcers formed, and were followed by caries of the bones, and by the discharge of fetid pus. The disease was said to have been imported by four sailors, who came from the banks of the Danube after the war against the Turks. The disease was probably identical with syphilis.

FALCADINA.—A disease which appeared in the year 1786, in the village of Falcado, contiguous to the Tyrol; its occurrence was attributed to importation through a female mendicant with ulceration of the pudendal mucous membrane. After general uneasiness, lassitude, sickness, osteocopic pains, and fever, a pustular swelling of the lips and mouth appeared, which proceeded to ulceration, affecting the velum palati, uvula, tonsils, and nasal mucous membrane; an eruption of a livid red color also appeared upon the skin. This disease was probably identical with scherlievo and syphilis.[3]

AMBOYNA PIMPLE.—A disease occurring in Amboyna and the Molucca Islands, described by Bonetus in 1718, characterized by ulceration of the soft parts, and by exostoses and caries of the bones, and transmitted independently of sexual intercourse.[4] Lancereaux[5] considers it identical with syphilis.

DISEASE OF ST. EUPHEMIA.—Under this name is described by Lancereaux[6] a disease which was observed in 1727 in St. Euphemia. A midwife had a pustule on her hand, followed by a general eruption of herpes; in the practice of her profession she communicated the disease to many women, whose bodies became covered with pustules, ulcers, and hard tubercles. The disease is considered by Lancereaux to have been a variety of syphilis.

PIAN OF NERAC.—This disease showed itself in Nerac in 1752, and is supposed to have originated from suckling a syphilitic child; the disease was first communicated to the nurse, and then to other children which used the same breast; it very much resembled the preceding disease.[7]

DISEASE OF ST. PAUL'S BAY.—Swediaur[8] described under this name a disease which appeared in Canada in the year 1760, among the fishing population of St. Paul's Bay. The disease first manifested itself in pustules on the lips, mouth, and tongue; these pustules were filled with a whitish fluid which was very contagious. At a later period the patients suffered from large ulcers, glandular swellings in the groin and throat, and violent nocturnal pains in the osseous tissues, with caries of the nasal, palate, and cranial bones, and sometimes loss of sight and hearing.

Dr. Stratton, who observed the disease among the North American Indians, found that it was most common among children and females, and that when it first appeared it was quite fatal. He did not consider it identical with syphilis, in this respect differing from Swediaur, Lancereaux, and Berkeley Hill.

[1] Lancereaux, op. cit., p. 41.　　　　[2] Copland, Dict. of Pract. Med., vol. iv. p. 1336.
[3] Craigie, op. cit., p. 725.　　　　　[4] Copland, op. cit., p. 1339.
[5] Lancereaux, op. cit., p. 38.　　　　[6] Ibid.
[7] Ibid.　　　　　　　　　　　　　　[8] Treatise on Syphilis, p. 451.

The treatment employed consisted in the use of sarsaparilla and a decoction of the hemlock spruce.

DISEASE OF CHAVANNE LURE.—This is described by Lancereaux as a disease beginning with weakness, and followed by nocturnal pains in the joints of greater or less severity; the mouth and throat were affected, and a pustular eruption appeared on the whole surface of the body, especially marked on the head. The use in common of eating and drinking utensils was the chief means of propagation.

Lancereaux regards this affection, as he does all the others which have been mentioned, as actually identical with syphilis.

VENEREAL DISEASES IN THE LOWER ANIMALS.

The question of the susceptibility of the lower animals to venereal diseases has for a long time claimed the attention of syphilographers, and numerous experiments have been made, by inoculating animals with the discharges arising from venereal sores in man, to prove or disprove their susceptibility to this class of diseases.

Hunter,[1] Ricord, Cullerier, and others experimented upon the lower animals by inoculating the discharge from the true chancre, with negative results as far as the production of constitutional syphilis was concerned, although a sore resembling the chancroid could be produced. On the other hand, De Weltz,[2] Auzias Turenne, and others, are said to have produced, by inoculation, sores which resembled the true chancre. M. Langlebert[3] states that he saw on the arm of M. de Weltz a well-marked chancre which had been inoculated by M. Ricord himself, who took the pus from a chancre on a monkey; but as at this time the distinction between the chancre and chancroid was not clearly drawn, and as no mention is made of the development of constitutional symptoms, little weight can be attached to this observation.

Recent investigations tend to confirm the observations of Hunter and Ricord, that the chancroid can be reproduced in the lower animals, while the inoculation of the discharge from the true chancre is only followed by an ulcer, local in its character, and unattended with symptoms of constitutional syphilis.

Jullien,[4] in speaking of the experiments of Auzias Turenne, says that they relate to the contagion of the chancroid, and that the symptoms following his inoculations were only visible to himself; and that, on the other hand, there have been too many negative results recorded by Ricord, Diday, Langlebert, Horand, and Puech—which contradict Auzias Turenne's observations—to allow us to give them the slightest credence. In regard to inoculations upon dogs, Jullien adduces the experiments of Velpeau, Bretonneau, Horand, and Puech, and the conclusions of Bouley, as showing that the lesions produced upon these animals are not different from the ulcerations so frequently noticed on the ears of certain hunting dogs.

The same observer, in speaking of a disease which exists among horses, and which is called the disease of coitus, and will be presently referred to again under the name of "La Dourine," says that though this malady, which is possibly venereal, and of which the contagious character seems

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[1] Vidal, Treatise on Venereal Disease (transl. by Blackman), p. 36.
[2] Ibid., p. 37.   [3] Ibid., p. 37.
[4] Traité Pratique des Maladies Vénériennes, p. 547.

scarcely disputable, has some singular affinities with syphilis, yet neverthe-less, scientifically, we are not in a position to say that it is syphilis. This disease was observed by Ammon in 1796, in the North of Persia, and has since spread to Europe and Africa; it is characterized by ulcers on the genitals, followed by eruptions on the skin, various nervous symptoms, pa-ralysis, and slow death. Ballardini described the affection in 1849 as syphilis of horses.

Carenzi, of Turin, in 1874, made experiments to determine the suscepti-bility of animals of the bovine species to the inoculation of syphilis, but un-fortunately the case on which he based his most positive conclusions has been interpreted in a diametrically opposite sense by Prof. Gamberini, of Bologna. The experiment was made upon a heifer which was inoculated with the pus from a patient suffering from multiple venereal ulcers; at certain intervals after the inoculation there appeared eruptions, induration of the mammary glands, loss of hair, and constitutional disturbance; at the end of 229 days all the symptoms had disappeared, and the general health of the animal was re-established. On the 131st day, Dr. Giacomini inoculated a young girl with the detritus of the heifer's first set of papules, and this operation was at the end of a week followed by the appearance of small distinct papules of a copper color, identical with those on the animal. According to Gamberini, the patient who furnished the pus for the first inoculation was suffering from chancroids, and the heifer did not present the symptoms of constitu-tional syphilis, the loss of hair being a common occurrence among ruminants during the month of March; the patient also who was inoculated from the heifer was only under observation for eight days, a circumstance which renders the observation valueless as regards the symptoms which she pre-sented.

Jullien also gives the results of inoculation in several other species of animals, all being negative as regards the production of syphilis; and concludes with the observation "that up to the present time syphilis remains entirely pecu-liar to the human race."

The conclusion of Belhomme and Martin[1] is to the same effect: that the syphilitic virus is not transmitted to animals, and that its inoculation is always followed by negative results; and that, on the other hand, the pus of the simple chancre (chancroid) can be transmitted to animals, giving rise to an ulcer the discharge from which, when reinoculated on man, gives rise to a simple chancre or chancroid.

The more recent investigations of Dr. Rabatel,[2] of Lyons, in which animals were inoculated with gonorrhoeal pus, with chancroidal pus, and with the material of the chancre, the operation being in each case followed by a nega-tive result, confirm the observations of previous investigators as regards the immunity of the lower animals from syphilis, but differ materially as to the results obtained by the inoculation of the matter of gonorrhoea and chancroid. The experiments of most value performed by this investigator were those made by introducing sections of recently removed chancres under the skin of a bitch, and by the injection of defibrinated blood of a man suffering from well-marked secondary syphilis, into the jugular vein of a dog. Neither of these animals exhibited any symptoms of constitutional syphilis, and addi-tional evidence of their immunity from this disease is presented in the fact that, as a result of their intercourse, the former gave birth to a litter of twelve healthy pups.

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[1] Traité de la Syphilis et des Maladies Vénériennes, p. 85.
[2] Lyon Médical, Juin 8, 1882.

Although, however, the lower animals seem proof against the inoculation of syphilis, they present some forms of venereal disease peculiar to themselves.

Williams[1] mentions urethritis as an affection seen in stallions and bulls, as a result of frequent coitus, but does not say whether the pus resulting from this affection is capable or not of reproducing itself under favorable conditions.

Horand and Puech,[2] who made observations concerning urethritis in dogs, found that the affection was rare, was characterized by a scanty secretion which issued from the anterior part of the canal, was accompanied by an intense balanitis, and was of short duration. They found that inoculation of the blennorrhagic discharges from man gave rise to urethritis in dogs and to vaginitis in bitches, but that the disease did not present the same series of symptoms that it does in man. They also observed that the balanitis of dogs was much intensified by the inoculation of the blennorrhagic muco-pus of man.

Hutrel D'Arboval[3] describes a disease occurring in the horse which simulates syphilis, and is characterized by an inflammation of the glans penis extending to the sheath, causing the organ to present a tense, shining appearance, and giving rise to phimosis and paraphimosis.

Under the name "La Dourine," Saint Cyr[4] describes a disease communicable by coitus, which has prevailed among the horses of the French army. The disease was first noticed in Tarbes, in 1854, and its reappearance in 1861 was due to the importation of an infected Arabian stallion; it has existed for a long time in Syria, and is probably the same disease which was described by Ammon (see page 598). The disease first attacks the reproductive organs, where it presents certain local manifestations; these are followed by numerous eruptions, and by constitutional symptoms, the most prominent of which is a paralysis of the animal's hind quarters, sometimes becoming general. The duration of the affection is from a few months to a year; the termination is generally fatal, the animal dying of exhaustion or hypostatic pneumonia, although recovery may sometimes occur.

[1] Practice of Veterinary Surgery, p. 630.   [2] Jullien, loc. cit., p. 26.
[3] Williams, op. cit.
[4] Annales de Dermatologie et de Syphiligraphie, 1876–77, p. 241.

SURGICAL DISEASES OF THE SKIN AND ITS APPENDAGES.[1]

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AFFECTIONS OF THE SEBACEOUS GLANDS.

COMEDO. (Synonyms: *Acne punctata; Grub.*)—When the secretion of the sebaceous glands is prevented from escaping, that portion which is exposed at the open mouth of the follicle becomes discolored by contact with external foreign matter, and forms a conspicuous dark speck resembling a grain of gunpowder embedded in the skin. By the continued accumulation of sebum within, the gland may become markedly prominent above the surface of the skin, and may attain the size of a mustard-seed or small shot; or by its distension may provoke an inflammation of the surrounding cutaneous tissues, and thus be converted into a true acne pimple. If pressed upon, the contents may be squeezed out in the form of a cylinder of white cheesy matter, which, with the blackened tip, resembles a maggot, whence the popular name, "worm," or "grub." Examined by the microscope, this material is seen to be composed of fatty and modified epithelial cells, cholesterine, and lanugo hairs, which have been prevented from issuing from the adjacent hair follicle by this hardened sebum plug within their common duct. Occasionally, too, one or more of the microscopic parasites (*demodex*) of these follicles are thus removed, although their presence is in no way connected with the formation of the comedo.

Comedones occur principally upon the skin of the forehead, nose, and temples, but may affect any portion of the body. Like other disturbances of the sebaceous glands, they appear most commonly at the age of puberty, but, if not removed artificially, may last for an indefinite period. They are apparently in no way connected with the general condition of the system, but are often associated with juvenile acne. The cause of their formation is not clearly understood. It may be an alteration in the normal character of the sebaceous secretion, an undue proliferation in the cells which line the exit duct, or a want of tone, or sluggishness, in the gland.

Treatment.—The surgical treatment of comedones consists in the forcible evacuation of their contents. This can generally be accomplished by the opposing pressure of the two thumb nails, but better by direct perpendicular pressure with a watch key. One with a small aperture and broad edge should be employed, so that the surrounding skin may not be too violently bruised. The operation should not be performed upon several contiguous glands at

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[1] The nomenclature and classification followed in the ensuing article are those adopted by the American Dermatological Association.

once, lest inflammation be excited in them. The following method may be observed with advantage: Let the affected parts be bathed or sponged with quite warm water for five minutes, and then rubbed with olive oil. In a few minutes more, the key may be applied with sufficient force to press out the now softened contents of the glands. This process should be repeated daily until all the comedones have been removed, and subsequently, as often as they continue to re-form. Much may be done to correct the sluggish action of the glands by the frequent use of strong soaps, in connection with liberal oiling of the skin beforehand. The best preparations are the liquid glycerine soap made in Vienna, or a solution of German soap (sapo viridis), or well made domestic soft soap, in alcohol, to which after filtration glycerine has been added. (R. Saponis mollis ℥j, alcohol f℥ij, glycerinæ f℥ss. M.) These should be rubbed into the previously oiled skin with a bit of sponge. The same sponge dipped in water should then be rubbed upon the part until a thorough lather is established, when water should be applied for a considerable time by the hands or a large sponge, until the soap is entirely washed off. Any overaction of the soap may then be corrected by the application of a little more oil, olive or almond, or of cold cream ointment or vaseline. The whole process is best carried out just before going to bed.

MILIUM. (Synonyms: *Grutum; Strophulus albidus.*)—This is another affection of the sebaceous glands, caused by retention of their secretion, in the form of pearly or yellowish-white, firm, little, globular bodies embedded in the skin and projecting slightly above its surface. These vary in size from that of a mustard-seed to that of a small pea. They lie just beneath the epidermis, and have no opening upon the surface. Their seat is most commonly the skin of the face, especially about the eyelids, and the male and female genitals. They are the result of an accumulation of sebaceous matter in one or more lobes of superficial glands, arising from occlusion of the sebaceous duct before its entrance into the common canal, as is shown by their occurrence along the edges of cicatrices, and after severe dermatitis; more generally, however, probably without mechanical obstruction, in consequence of changes in the character of the secretion. The contents of these little cysts are found to consist of hardened epithelial cells, arranged in concentric layers at the periphery of the globular mass, and, in the central portions, of firm but more fatty sebaceous cells. Colloid degeneration of the epidermal contents has once been observed. When occurring in great numbers, as they sometimes do, upon a darkly pigmented skin, they become a serious deformity.

Treatment.—Milia may be removed easily by cutting through the thin overlying epidermis, and squeezing out their contents with the nail or the edge of the knife. A slight degree of bleeding sometimes follows, which is readily checked by pressure.

SEBACEOUS CYSTS. (Synonyms: *Atheromata; Wens.*)—These tumors, situated within and beneath the skin, consist of hypertrophied sebaceous glands filled with their retained and more or less modified secretion. They vary in size, generally from that of a pea to that of a pigeon's egg, but are sometimes larger. They may occur on all parts of the body, but their most common seat is the scalp, and they may occur singly or in considerable numbers. The orifice of the affected gland is generally obliterated, but sometimes remains open, and may be so much enlarged as to admit a probe. The tumors are soft, or firm and elastic to the touch, are movable, and vary in shape according to their age and the resistance of the overlying skin, being flattened, or prominent and globular. The integument above them almost always remains in its

natural condition, but the scalp becomes denuded of hair when they attain any considerable prominence upon it, and may assume the condition of senile atrophy above them. Their growth is very slow, and they may exist for years, or a lifetime, without producing other inconvenience than that which arises from their size alone. When the cyst is removed by dissection from its enveloping tissues, its walls are found to be soft, thin, and fragile, when of recent formation, but much thickened when old, and sometimes permeated by calcareous deposits. The internal surface of the cyst is smooth, but has sometimes a villous appearance. The contents vary greatly in consistence and color. In the early stage, they are generally the retained sebaceous matters, resembling curds. At a later period they become, in character, more like epithelium in various states of transformation, mixed with fat and cholesterine (*Cholesteatoma*). Sometimes they undergo nearly complete liquefaction, or are honey-like in appearance (*melicerous*). Fine hairs are occasionally found in them, and calcareous matter. Rarely a horny epithelial growth starts up within the cyst, and may eventually be converted into a *Cornu cutaneum*. The contents are never hemorrhagic, as the walls are not vascular. The sebaceous cyst is liable to inflammation at times, without apparent cause. It may be converted rapidly into an abscess-like mass of suppuration, confined within its walls; or the overlying integument may become purple, soften, and undergo perforation, and a fistula may thus be formed, through which extremely fetid pus may be discharged for a long time, in which case the underlying cranial bone may be found carious, or the protecting skin may slough extensively, leaving a mass of ulceration which may extend to the surrounding tissues and present a very malignant appearance. Although ordinarily of easy recognition, the sebaceous tumor in its later stages, especially when of considerable size, or when its walls have become thickened, may be confounded with more serious growths, as hæmatoma or carcinoma.

Treatment.—Sebaceous cysts may be removed by excision, or destroyed by caustics. Under ordinary conditions, or when of any considerable size, extirpation by the knife is the proper method of treatment. The overlying skin should be put on the stretch and cut carefully through to the cyst wall, over the whole length of the tumor. By careful dissection, the cyst may then generally be removed entire. Should the walls be cut or ruptured accidentally, the contents should be evacuated by pressure, and every portion of the envelope dissected out with great care. The wound generally unites by first intention. [In excising sebaceous cysts from the region of the scalp, it is more convenient to transfix the base of the tumor with a slender bistoury, and then bisect the growth by cutting directly upwards. Unless it has been inflamed or ulcerated, the cyst wall is very loosely attached in this situation, and can usually be pulled out with forceps without the trouble of dissection.]

The danger of erysipelas attendant upon all operations upon the scalp must, of course, be borne in mind when this is the seat of the tumor. It is on this account that some surgeons prefer to employ caustics upon this region, when the cyst does not exceed a pigeon's egg in size. For this mode of treatment, caustic potassa, Vienna paste, or nitrate of silver, may be used. When the cyst is quite small, a pointed stick of nitrate of silver may be moistened and made to revolve gently upon its tip on the skin above the tumor, until it penetrates its tissues slightly. A small eschar is thus produced, which falls in a few days. The operation is then repeated, and the stick is made to enter the cyst, and to come in contact with the walls. The envelope may then be removed with fine forceps, after emptying the contents by pressure, and the cavity, in three or four days, closes by adhesion of its walls, and leaves an imperceptible cicatrix. Upon larger tumors, the Vienna paste may

be used in the following manner.[1] The surface is covered with diachylon plaster, from which a button-hole has been cut out, of the length of the tumor, and of one-quarter its width. A coating of the paste, diluted with alcohol, is then laid upon this opening. After fifteen or twenty minutes, the paste is carefully and wholly removed. In two or three weeks the eschar is detached, bringing with it the shrivelled and mummified cyst. After a few days, the large and deep opening cicatrizes, and leaves behind only a small linear scar.

MOLLUSCUM CONTAGIOSUM. (Synonyms: *Molluscum sebaceum* ; *Epithelioma molluscum* (Virchow); *Condyloma subcutaneum*.)—Under these titles, there have been described by different writers, small tumors of the skin, the identity and true nature of which have long been the subject of controversy. They are semi-globular, conical, or flattened prominences, of the same color as the skin, sometimes shining and transparent, sometimes warty in appearance. In size they vary from that of a pin's head to that of a large pea. They generally present a minute opening at the tip, or, when large, an umbilical depression, which gives them a resemblance to the efflorescence of varicella. Their seat is most commonly the face, neck, or genitals, but they may appear upon nearly all parts of the body, and in numbers varying from one or a few, to a hundred or even more. Their growth is generally slow, and their course chronic; they may at times disappear spontaneously. Their presence is unaccompanied by any disturbance of sensation of the part, except when they are accidentally the seat of inflammation, by which they may be destroyed. They are observed more frequently in children than in adults. If one of the growths with a visible opening be firmly squeezed between the thumb nails, its contents may be pressed out in the form of a fluid, creamy material, which consists of epithelial cells, fat globules and crystals, and certain larger, irregular, ovoid, shining bodies, some of which are enveloped in a thin epidermal covering. These peculiar bodies have been called *molluscum corpuscles*, and are regarded as epithelial cells, the protoplasm of which is in a state of amyloid degeneration. They are not peculiar, however, to these growths. If one of the tumors be examined in section, its structure will be seen to be multilobular, like the sebaceous glands, and to contain a central cavity. The peripheral cells resemble those of the rete, and are arranged like them in superimposed layers. It is on this account that several authors regard these growths as belonging to the rete and not to the sebaceous system, among the affections of which they are usually classed. It is in the central portion that the peculiar large cells are found. Clinically, Kaposi divides them into the encysted form (*Molluscum atheromatosum*), and the wart-like variety (*Molluscum verrucosum*).

As to the property of contagiousness, implied in the specific title bestowed upon this affection by Bateman, observers are still at variance, and the question may still be regarded as an open one. Those who support the theory of contagion, offer numerous facts concerning which there is no doubt: that the disease has been frequently observed at the same time upon the face of an infant and the breast of its nurse; that it has affected several members of a family in succession; that the entrance of a child, thus affected, into a hospital or foundling asylum, has been followed by the appearance of these growths upon its nearest fellows, etc. On the other hand, there are no perfectly satisfactory successful experiments by inoculation, to support this view, although negative results in this direction are of little positive weight, because the requisite conditions for successful transference of the possibly inoculable matter

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[1] Misset, Étude sur la pathologie des glandes sébacées, 1872.

may not have been observed. Experiments failed for many years to establish *Tinea favosa* upon the skin of a second host, although it was known that the disease was contagious, and that the material used was parasitic.

Treatment.—The treatment of these growths consists in evacuating their contents by forcible pressure with the thumb-nails, when they are pervious, and in arresting the free hemorrhage which follows by pressure. When in the form of closed cysts, they may be scooped out with the sharp spoon (curette), or removed by the knife or curved scissors. When very numerous and closely packed together, exfoliation of the overlying integument and discharge of their contents may be accomplished by covering them with compresses thickly spread with German or domestic soft soap. The application of solid nitrate of silver or caustic potassa to the interior of the cysts, after squeezing out their contents, has been advised, but is seldom necessary.

INFLAMMATIONS OF THE SKIN.

DERMATITIS VENENATA.—Many substances when brought in contact with the skin are capable of exciting an inflammation of its tissues. The forms of dermatitis of this character, most frequently observed, are those produced by the poisonous species of Rhus (sumach), by tincture of arnica, and by certain dyes. The frequent occurrence of cases of poisoning by the plants mentioned, makes it the duty of physicians to acquaint themselves with their botanical characters.

Poison ivy, as it is popularly called, is not an ivy, but belongs to the sumachs. It is the *Rhus toxicodendron*. It is sometimes a vine (*Rhus radicans*) running over or by the side of stone walls, fences, and ledges, or ascending trees to a great height, and sometimes a bush of considerable size and thickness (poison oak). It is found almost everywhere in the United States, in many places growing in great abundance, and forming dense masses by roadsides, in pastures, and along the borders of woods. Its leaves have a marked and very characteristic, glossy look, and vary greatly in shape, size, and outline. They are ternate, that is, they consist of three leaflets, one terminal and two lateral, growing in common upon a rather long, semi-cylindrical stem. The leaflets are ovate, with rather a broad base, more or less pointed, and their edges are either entire, or notched and lobed in a great variety of forms. This plant blossoms in June, and the flowers are small, and grow in greenish-white clusters, mostly on the axils. The berries are small, round, and also of a pale greenish-white color. Later in the season, the leaves assume a great variety of most brilliant colors, and attract many gatherers of autumn foliage. At this season it may readily be mistaken for our common woodbine or Virginia creeper (*Ampelopsis quinquefolia*), unless it be remembered that the number of leaflets in the latter is five.

The other poisonous species of Rhus, *Rhus venenata*, a small tree, growing mostly in swamps and low places, is much more virulent than the former, but is not so common. Its popular names are " poison dogwood," " poison sumach," " poison ash," etc. Its leaflets, like those of the ordinary sumach, grow in opposite pairs upon a long stem, and vary in number from seven to thirteen. They are smooth, glossy, broader than the harmless species of sumach, and the terminal one grows from a considerable prolongation of the common stem. In the autumn its foliage surpasses that of all other trees in the variety and brilliancy of its tints, and thus attracts to its less frequented haunts not a few unwary visitors.

The virulent principle of these plants is a volatile acid, which exists in all their parts, but especially in the leaves. All persons are not affected by it,

but many who can handle the vine, *Rhus toxicodendron*, with impunity, are poisoned by the tree, *Rhus venenata*, so much more virulent is the latter. Actual contact with the plants is not in all cases necessary for the production of their poisonous effects, on account of the volatility of their active principle ; and there is good reason to believe that persons highly sensitive to the poison not unfrequently suffer on passing by places where the vine grows abundantly. The plant is supposed to be most actively virulent during the flowering season, in early summer, but cases of poisoning occur with great frequency throughout the autumn, when the leaves take on their seductive coloring. Even in the winter, the twigs and stems are often found still alive for mischief by those who handle them.

The peculiar effect of the poison is of the same character upon the skin of all who are affected by it, differing only in degree of intensity and extent of distribution, viz., an inflammation of the eczematous type. It is characterized by an eruption of vesicles, at times of a peculiar lurid or brownish-red color, which may subsequently burst and exhibit the later phases of this efflorescence, as in other forms of dermatitis. In severe cases we have multiplication of the number of vesicles, either single or massed in groups, covering large surfaces, or by fusion forming blebs. In addition, there are more or less redness and œdema of the surrounding integument, sometimes to a very marked degree, so that great deformity may thus be produced, the face of the patient being changed out of all possibility of recognition. These changes in the tissue of the skin are accompanied by intense itching and burning, and often great suffering is undergone by the patient in consequence. There is rarely, however, any constitutional disturbance. If then the cutaneous manifestations are those of acute eczema, have they no individuality by which they may be distinguished? There are differences to be recognized by the practised eye, but they are more easily detected than described. The eruption appears most easily, therefore generally first, upon the lateral surfaces of the fingers, or along their edges ; at a later period, upon the dorsal surfaces ; and last, upon the thickened palms. It is more scattered and more irregular in its distribution than that of ordinary eczema. The character of the efflorescence, too, is strikingly peculiar, although indescribable. It is more uniformly vesicular than vesicular eczema. The vesicles appear less transparent, as if the effusion of serum had taken place in the lowest layers of the rete, and they have at times a peculiar tinge of color, as if slightly hemorrhagic from the intensity of the inflammation. Upon the palmar surface, the epidermal coverings of the vesicles are so dense that they look and feel more like papules. In its later stages, those of involution, the skin returns to its natural state without any marked change in the character of the efflorescence.

In mild cases, the inflammatory process is seldom carried so far as to transform the vesicle into a pustule, and, after reaching its height, its serous contents are slowly absorbed, and it flattens down, leaving a fugitive, dull-colored stain to mark its seat. In the severer forms, the œdema and hyperæmia rapidly subside under treatment, and the excoriations, crusts, and infiltration, disappear in the same manner as in acute eczema. The eruption generally shows itself within three or four days after contact, sometimes within twenty-four hours, and the duration of the attack depends largely upon the protraction of the period during which fresh efflorescences manifest themselves. This generally lasts from ten to fourteen days from the appearance of the first eruption. Even in the severest cases, where the changes of tissue reach their highest possible development, and affect large surfaces of the body, the duration of the whole process of evolution and involution rarely exceeds three or four weeks. No scars or permanent injury to the skin are to be apprehended.

There is no ground for the popular belief that the poison renews its activity

after the lapse of time, although there is good reason for believing that the skin is more liable in some persons to inflammatory disturbances, for some years it may be, after an attack of rhus poisoning. Acne and acute eczema are the secondary affections most commonly observed as its sequelæ. Susceptibility to the action of the poison seems never to diminish in the same individual, however often affected by it.

The question is often asked by patients : Is ivy-poisoning contagious ? will contact with the eruption, or the fluid discharge, produce the disease upon other parts of the same person, or upon the skin of another individual ? It is not at all improbable, that a person who had been handling specimens of rhus, might, by immediately taking the hand of another, excessively sensitive to its action, and before the volatile principle had been dissipated, washed away, or absorbed, convey the poison, which would subsequently prove effective. It is, no doubt, in this way that the face, penis, and other parts of the body become affected, where the hands only have come in direct contact with the plants ; but the freest handling of parts affected, in all stages of the efflorescence, fails to transfer the disease to the hands of another.

Treatment.—The poison, as has been stated, is a volatile acid. An alkali would, therefore, suggest itself as the most fit agent to counteract its action. Thorough washing of the parts, as soon as possible after contact with the poison, in cooking soda or saleratus water, or in strong soapsuds (especially if made with soft soap, which contains an excess of alkali), is therefore the best immediate treatment. When these or other alkaline preparations are not to be obtained, an abundance of water alone should be used as soon as possible. After absorption has taken place, or when the eruption has begun to show itself, less benefit is to be expected from such applications alone. Remedies are then to be used which will best control and shorten the inflammatory process in the tissues of the skin : those, in fact, which are found to be most efficacious in corresponding stages of acute eczema. Among these are some which have a special reputation, as solutions of acetate of lead or sulphate of copper, applied frequently as a wash. A large number of vegetable substances have been recommended as exerting a specific action upon the course of the disease, when locally applied. Among them are white-oak bark, black alder, grindelia robusta, and serpentaria. Bromine has lately been added to this list. Perhaps nothing is better than black wash (calomel ℥j, lime-water Oj), used as an evaporating lotion for half an hour at a time, twice daily—the lime-water acting also as a chemical antidote, if, possibly, such action be still in season at this later stage. In the intervals between the applications of these washes, the parts may be kept covered with cold water dressings, with plasters of diachylon ointment, or with a powder of starch ℥j, oxide of zinc ℥j, according to the familiar rules for the treatment of acute eczema. By such means the inflammatory process is checked or shortened, and the sufferings of the patient are greatly alleviated.

ARNICA POISONING.—The *tincture of arnica* is another frequent source of " poisoning," when applied to the external surface as a popular remedy in sprains and bruises. It causes, upon some persons, an intense dermatitis of an eczematous type, but necessarily upon a small proportion only of those who use it, inasmuch as it is employed in enormous quantity for the purpose named. The cutaneous manifestations consist in the development of hyperæmia, papules, vesicles, excoriations, crusts, and scales, in regular sequence, accompanied by intense itching and some degree of burning in the parts affected, but by no constitutional disturbance. The inflammation begins in the parts to which the arnica has been applied, after intervals varying from a few hours to several days, but may spread from such centres to

wider areas, in consequence of scratching, or may be developed upon distant regions which have come in indirect contact with the arnica by the agency of the hands. The affection follows a very regular course in the character, distribution, and duration of its lesions, differing materially in some of these respects from the wayward manifestations peculiar to the action of rhus. Like the latter, arnica must be regarded as an irritant poison when applied to the skin, but of less intensity and of less certainty in its action. Its properties reside in an acrid resin and volatile oil. The appearances which follow its use are, no doubt, often mistaken for the immediate effect, or, for the sequelæ, of the injury or other affection for which it has been applied. Even the physician sometimes fails to recognize the artificial nature of the eczema which he is called to treat, and to connect it with the prior application of arnica to the skin. The almost universal belief in the harmlessness of the remedy, too, prevents, in most cases, the patient from communicating to the physician the fact of its use before the appearance of the disease. Cases have been recorded in which the inflammation extended below the skin, producing destruction of the tissues.

The *treatment* is the same as that in an eczema of the same grade (page 614). The excessive œdema and hyperæmia require that the leg, if this be the part affected, should be kept in a horizontal position, and that cold, evaporating lotions should be assiduously employed. The course of the dermatitis under treatment is ordinarily brief.

MEDICINAL RASHES.

Under this title may be mentioned *Dermatitis venenata*, as also those forms of inflammation of the skin which follow not only the application to its surface, but the internal administration, of certain drugs used in the treatment of disease. These can be only very briefly considered.

I. *External Applications.*

The substances included in this class do not comprise those which are used in medicine for the express purpose of producing a greater or less degree of dermal inflammation—the so-called rubefacients and vesicants, such as mustard, cantharides, croton oil, tartar emetic, etc.—but those only which are applied to the skin for other purposes.

ARSENIC.—The action of arsenical compounds upon the cutaneous tissues varies greatly in intensity. Among the milder effects of such contact, are the hyperæmia and papulation produced by the application of the pastes, consisting largely of arsenic and quicklime, so commonly used for the removal of superfluous hairs upon the faces of women, and the more extensive and severe forms of dermatitis produced by wearing garments dyed with arsenical pigments, varying in intensity from simple congestion to vesicular and bullous lesions. It is not improbable that such sources of cutaneous inflammation are often overlooked, as arsenic is now largely used in the preparation of coloring matters, not only for garments worn next the skin, but for ladies' cloths, carpets, hangings, etc. Wall papers, wrapping papers, and playing cards containing arsenic, have caused similar effects upon the skin. The severer forms of inflammation produced by the action of this substance upon the hands of workmen employed in the manufacture of the above-named articles, are well known; they are pustular, ulcerative, and gangrenous in character. This very destructive power of arsenic upon the cutaneous tissues is, as is

well known, called into operation by the surgeon in the treatment of lupus, carcinoma, etc.

MERCURY.— The over-stimulating properties of the many preparations of this substance employed in the local treatment of skin diseases, are familiar to all. When employed in the form of a vapor bath, or in the inunction cure for syphilis, the papular inflammation excited upon the skins of some persons often interferes with the continued and proper employment of the remedy.

TAR.—The various tars used upon the skin in the treatment of disease, or for toilet purposes, frequently develop a considerable degree of inflammation, mostly in the form of a folliculitis, but sometimes in that of pustules of large size, a real acne.

SULPHUR.—This is a decided irritant upon many skins, and, when employed as a parasiticide, or otherwise, often gives rise to acute eczematous inflammation.

IODINE.—The tincture of iodine occasionally produces a deep-seated dermatitis beneath the surface upon which it has been painted, and, rarely, a milder form of inflammation spreading widely from such centres of application.

BALM OF GILEAD. (*Populus candicans*).—A tincture of the buds of this tree is, in some parts of the country, used as a domestic remedy for sprains and bruises. It produces at times a dermatitis closely resembling that caused by arnica.

CHRYSOPHANIC ACID, OR CRISAROBIN.—This substance, the active principle of Goa powder (both of common use in the treatment of the vegetable parasitic affections, and in that of psoriasis), produces, in addition to its staining the epidermis, a moderate inflammation of the skin, which frequently prevents its further employment. Upon the face it almost always causes marked œdema, and should never be applied to this part.

Here might be mentioned the names of many celebrated quack lotions and ointments, which are now in general use by all classes of people, and which, when applied to the general surface, at times give rise to serious forms of dermatitis.

II. *Internal Remedies.*

The substances which give rise to disturbances of the skin when they are administered internally, can only be mentioned by name, inasmuch as they do not especially belong to the province of surgery. They are:—

ARSENIC:—Erythematous, papular, urticarial, bullous, pustular, and purpuric efflorescences.

BELLADONNA:—Erythema, scarlatiniform rash.

BROMINE:—Macular, papular, pustular, flattened nodular, or acneiform eruption, sometimes bullous.

CHLORAL:—Erythematous, urticarial, and papular forms of efflorescence, occasionally purpuric.

COPAIBA:—Erythematous and urticarial efflorescences combined.

CUBEBS:—Erythematous or papular. (Rare.)

DIGITALIS:—Erythematous or papular. (Uncommon.)

IODINE:—Erythematous, papular, vesicular, pustular, or acneiform efflorescence; sometimes bullous; rarely purpuric.

Opium :—Erythematous, finely papular, at times urticarial eruption.

Quinine :—Erythematous and papular, with desquamation ; at times urticarial ; rarely hemorrhagic.

Salicylic Acid :—Erythematous, urticarial ; occasionally vesicular and pustular.

Turpentine :—Erythematous, papular eruption.

Eruptions following Operations and Injuries.

Attention has of late years been occasionally called to the not infrequent occurrence of rashes and other forms of cutaneous disturbance after surgical operations. This subject of traumatic eruptions has recently received a careful study from Mr. Edward C. Stirling, of London. From his observations, which are published in St. George's Hospital Reports, Vol. X., it appears that there are two classes of such manifestations : one, true scarlatina ; the other, comprising erythema, urticaria, and herpes. Of the former he cites sixty-three instances following operations of every degree of severity. The rash appeared within three days after the operation in 78 per cent. of the cases, and in every instance within a week. Of the direct connection between the development of *scarlatina* and the traumatic state there can be little doubt, but it can only be explained on the supposition of some peculiarly favorable receptivity to the poison induced by the operation. The course of the disease differs only in unimportant respects from that of ordinary scarlet fever. The other forms of eruption which have been observed after operations and injuries are : (1) An *erythema*, or *roseola*, of more or less general distribution, resembling very closely the rash of scarlet fever, but lacking all other essential characteristics of that disease, and subsiding in the course of twenty-four or forty-eight hours ; in some cases the erythema has been of a papular type ; (2) *Urticarial* and *herpetic* forms of efflorescence, which are not as frequent as the erythematous. They have been observed even after simple catheterization. The occurrence of such traumatic eruptions has been accounted for on the hypothesis of absorption of the inflammatory products of the wound, or by so-called reflex irritation. They are not to be confounded with the cutaneous manifestations of septicæmia.

Eczema.

Eczema is an inflammatory affection of the skin, acute or chronic in course, characterized by a great variety of surface lesions, and accompanied by itching. It presents a number of distinct clinical varieties according to the stage which may be under observation, and which may be recognized under the appropriate titles : *Eczema erythematosum, Eczema papulosum, Eczema vesiculosum, Eczema madidans, Eczema pustulosum,* and *Eczema squamosum.*

Eczema Erythematosum.—In this, the mildest grade of the disease, as far as the anatomical changes in the cutaneous tissues are concerned, we have a simple reddening of the skin, either in the form of minute points and larger maculæ, or distributed over larger surfaces, due to a hyperæmic state of the capillaries which supply the parts affected. This condition, accompanied by heat and itching, may exist as a simple erythema for a few days, and may fade away, leaving only a slight desquamation behind. If it persist longer, however, a thickening of the reddened skin, which may be recognized by touch, will follow, due to an exudation of cells and serum from the enlarged

vessels, and this condition may last indefinitely. It may disappear by re-absorption of the exudation, or may be developed into more advanced forms of the affection.

ECZEMA PAPULOSUM.—This is characterized by the development of red eleva-tions, varying in size from that of a pin's head to that of a small pea, scattered more or less sparsely over the affected surface, or closely arranged in groups. These papules are produced by the distension and elevation of the papillæ by an exudation, from the greatly enlarged vascular loops within them, of serum and cells, and, although apparently devoid of free fluid, they will, if their outer horny layer of epithelium be pierced with a needle, allow a minute drop of serum to exude. These papules may, individually, last a few days only, or for much longer periods, and they may disappear by absorption without further transformation; or their tips may be excoriated by the scratching which the attending itching provokes, and this may give rise to the establishment of serous and hemorrhagic crusts; or they may become converted into more advanced forms of efflorescence, viz., the vesicle or pus-tule. This variety of eczema is still called *lichen* by some dermatologists.

ECZEMA VESICULOSUM.—Vesicles in eczema may appear primarily as such, or may be developed from preceding papules. The exudation of serum in-creases within the papillæ, oozes up into the mucous layer of the epidermis, pushing apart the cells of the rete and drawing them out into thread-like forms, and finally penetrates to the horny layer, which resists its upward flow. Thus we have formed a chambered or compound vesicle, having its septa made up from the elongated cells of the rete, its base being the lowest cells of the latter, and its roof the horny layer. In this way the papular eczema of to-day may become to-morrow an eczema vesiculosum. The vesi-cular variety is one of the rarest forms of the disease, notwithstanding that Willan and his followers have regarded this as its typical and elementary lesion. It is always an acute stage. The vesicles may remain as such for a few days, when, their contents becoming absorbed, the overlying roofs of epithelial cells flatten down, and are thrown off finally in the form of scales. Usually, however, this natural process of involution is not followed, for the roofs of the vesicles are either torn off violently by the nails in scratching, or the exudation from below is so great as to burst through the horny epithelial coverings. In either case, an abundance of clear serum oozes from the de-nuded and inflamed surface, and coagulates in the form of yellowish crusts.

ECZEMA MADIDANS.—When large surfaces are thus deprived of their protect-ing epithelium, and large tracts of the hyperæmic papillary layer of the skin are exposed, this weeping, moist condition is called *Eczema madidans*. In case the inflammation be of extraordinary intensity, or if the tender, denuded mucous or papillary layer be wounded further by scratching or pressure, bleeding takes place from the enlarged vessels, and we have the formation of hemorrhagic crusts in place of the simple, yellow, serous form of the disease. Beneath these crusts, sooner or later, a new epidermis forms, which for a time remains somewhat reddened and scaly before the integument is restored to its completely normal condition.

ECZEMA PUSTULOSUM.—If, however, the vesicles are not ruptured in this way, by violence or excessive exudation, and if absorption does not take place immediately, their clear contents may become turbid by the penetration with-in their cavities of pus cells. This transformation of a vesicle into a pustule may take place rapidly, or a sero-purulent exudation may at once push up the

epidermis into pustules. In both ways there is established an *Eczema pustulosum*. So, too, in eczema madidans, the serum oozing from the excoriated surfaces may become purulent, and greenish sero-purulent crusts may then be formed. This condition is also called eczema pustulosum, the extreme grade of eczematous inflammation.

Eczema Squamosum.—In the retrogressive stage of all these forms, the skin may be left for an indefinite time in a reddened condition, with an imperfectly formed epidermis, as shown by the presence of scales, either fine and branny, or adhering in thicker and flaky masses. This condition is known as *Eczema squamosum*.

Symptoms and Course of Eczema.—When any of these forms of eczema has lasted for some time, or when those of short duration have recurred at brief intervals upon the same part of integument, a thickening takes place in the underlying tissues of the latter, due to the presence of immense numbers of round cells in the upper layers of the corium. The skin is firmer to the touch, is less elastic, and is not easily pinched up in folds. This tissue change is called *infiltration*, and it may persist for an indefinite period after the surface lesions, which preceded it, have disappeared. It is always the essential feature of chronic eczema, a measure of the past and future duration of the case in which it occurs. As a later and characteristic manifestation, also, of chronic eczema of long standing, when the skin has lost its elasticity in consequence of this cell infiltration, *cracks* or *fissures*, often extending deeply into the corium, are formed over parts often stretched, as over the joints, and these may give rise to hemorrhagic crusts. In patches of chronic infiltration, too, where the vitality of the skin has been reduced, as upon the lower legs in consequence of impeded circulation, the tissues often undergo ulceration, and the process of repair is extremely slow. The coloring matter of the blood, moreover, is extravasated at times in long-continued eczema of these parts, and permanently stains the cutaneous tissues. Diffused *discolorations* and *cicatrices* of the lower leg, therefore, frequently mark the seat of a former eczema. As a rare complication or sequela of the disease in its chronic varieties, a hypertrophy of the papillæ of the skin, in the form of *papillomatous elevations* of various sizes, may be developed in consequence of the superabundant supply of plastic material.

In its varying phases, then, eczema may present the following lesions: the hyperæmic macule, papule, vesicle, pustule, excoriation, crust, scale, and fissure; and as one or other of these predominates at any moment, we have a so-called eczema erythematosum, papulosum, vesiculosum, madidans, pustulosum, or squamosum. Several of these varieties may be present at the same time upon different or contiguous portions of the skin of an individual, and may change, by development or involution, the one into the other. The disease may apparently begin in any of these forms, excepting eczema squamosum, and may run through its various stages so rapidly, that the early and intermediate ones escape notice. To these, the earlier manifestations, may be added in time more deeply seated tissue-changes, such as cell-infiltration, ulceration, pigmentation, and hypertrophy of the papillæ.

Eczema may be *acute or chronic*, in form as well as in course. The former variety is characterized by lesions, acute both in character and duration, which may recur over and over again, and thus protract the history of the case indefinitely, and yet remain acute in type. The characteristic feature of the chronic form is cell infiltration. The two conditions may, therefore occur in combination, acute surface lesions being developed upon old infiltrated patches of skin.

Apart from the multiplicity of its forms, due to the protean character of its lesions, the appearances of eczema vary greatly in individual cases, according to its seat and etiological relations; but space permits the consideration of those varieties only which have direct, practical relations to surgery. Eczema is frequently caused by the use of the *mechanical apparatus* and *chemical applications* to the skin, employed in surgery, resulting from undue *pressure* or *friction*, or, in the latter case, from a *macerating* or *irritating* action upon the surface. Of the former causes we have an example in the acute inflammation produced by the pads and straps of trusses, which often prevents their proper employment, especially in hot weather and in persons habitually disposed to eczema. Much may be done to prevent such disturbance by judicious selection of the material and surface structure of the pad, and by frequent change in the arrangement of the straps which tend to produce chafing. By proper local treatment of the eczematous patches during the night, moreover, the evil effects of the unavoidable use of such apparatus by day may be counteracted, and their constant use may thus be rendered possible. The forms of eczema produced by such appliances are, at first, generally of mild type, the erythematous, readily assuming, however, the condition of eczema madidans in parts where, in addition to the mechanical pressure and friction of the harness, two surfaces of skin are in frequent contact, as in the groin, the opposing faces of the scrotum and thigh, the abdominal folds of old and fat people, etc. At a later period, the cutaneous tissues may become much thickened by cell-infiltration.

Of the ill-effects, in the same direction, of *maceration*, we have illustrations in the action upon many skins of water-dressings and poultices. Eczema thus produced, begins generally in the form of a simple folliculitis, which may be converted into a continuous eczematous dermatitis, or the "madidans" or "pustulosum" variety, or which may extend into the deeper periglandular tissues in the form of furuncular inflammation. Much mischief is often thus produced by the injudicious employment of poultices upon the skin surrounding diseased centres of various kinds. Poultices should therefore be made no larger, nor worn any longer, than the original process under treatment absolutely demands. The legitimate softening action of the poultice may in many instances be obtained by the application of thick layers of lard, without injury to skins readily disposed to this form of inflammation. The same results often follow the application of the rubber bandage, where, in addition to the unrelaxed pressure, we have the parts constantly bathed in the confined perspiration. In such cases, too, we may, by proper treatment of the inflamed skin after the removal of the bandage, at bedtime, be enabled to employ it without interruption throughout the day. By prolonged water-dressings, deep-seated furuncular inflammations of the cutaneous tissues are occasionally produced, the same as those which result from the action of the Priesnitz water-cure upon the skin, the so-called critical eruptions.

Of the other class of applications, those which from their *irritating* effects upon the skin are most likely to produce eczema, the most common in surgical use are ammoniacal liniments, mercurial preparations, carbolic dressings, and arnica. They excite ordinarily the erythematous or papular forms, rarely higher stages of inflammation, unless the employment of the irritant is continued. The repeated application of mercurial ointment is often interfered with by the folliculitis or more diffused dermatitis which it produces, but in the inunction cure of syphilis these ill effects may almost always be prevented by rubbing the ointment into the lower legs the first night, into the thighs the second, the abdomen the third, the sides of the chest the fourth, the upper arms the fifth, the forearms the sixth, the lower legs the seventh night, and so on. By such rotation, the process may be employed continu-

ously for months without exciting eczema.   Carbolic acid, when applied in concentrated form to the skin, may produce intense dermatitis, or an eschar of varying depth, and even in the weak solutions of ordinary surgical prac-tice, is capable of exciting a mild eczema upon the hands of the attendants. Arnica, although rarely employed by the surgeon, is of almost universal use in domestic medicine, and is the frequent cause of artificial eczema. (See page 607.)

All these forms of artificial eczema, although ordinarily confined to the parts of the integument under the immediate action of the irritant, may afterwards assume a wider distribution, and may even become chronic in persons liable to the disease.

Eczema from Vaccination.—In addition to the graver forms of dermatitis, occasionally excited by vaccination about the point of inoculation, a true eczematous inflammation is not infrequently developed around its immediate vicinity, and may subsequently occupy a large portion of the vaccinated limb, or be the centre of a more general distribution.   The part is sometimes covered with thick sero-purulent crusts of considerable extent, which appear to be continuous with the original vaccine scab, so that it is not at all strange that the belief should be entertained, in such cases, that the cutaneous disease is the result of impure vaccination.   Less immediate and more general forms of eczema are also sometimes stimulated into existence during the course of vaccination in children, as the result of the excitement produced in all the tissues by the virus.

TREATMENT OF ECZEMA.—The treatment of all these forms of eczema is usually simple, because the type of affection presented is generally acute in the char-acter both of its lesions and of its course.   Often the recognition and removal of the exciting cause is sufficient for the restoration of the skin to health, in a few days.   When eczema is produced by friction and pressure of surgical appliances, black wash (R. Hydrargyri chloridi mitis ℥j, Liquoris calcis Oj) should be applied to the affected parts upon a thin cloth, as an evaporating lotion, for half an hour morning and evening, when it is possible to remove the apparatus for so long a time.   The cloths should be removed and dipped in the wash every five minutes during the application.   If the apparatus can be laid aside during the night, as in the case of hernia, cloths smeared with diachylon ointment[1] may be applied at bedtime to the inflamed parts, after the wash, and may be worn until morning.   It may be well before reapply-ing the apparatus, to dust the affected parts, especially where two folds of skin come in contact, with a powder of zinc oxide and starch (℥j-℥j).   When the excoriations are healed, or in milder grades of inflammation, a zinc wash may be used (R. Zinci oxidi ℥ij, Liquoris calcis f℥viij. M.), sopped on freely with a bit of soft cotton rag, and allowed to dry upon the affected parts.   It may be applied as often as the apparatus can be removed for a few minutes. This wash may also be used to harden the skin after the removal of a rubber bandage, at night, or to counteract the excoriations and follicular inflamma-tions induced by its macerating action.   For the similar mild effects of water-dressings and poultices, the same remedy is often efficient.

In the graver and more widely diffused forms of eczematous inflammation, produced by the irritants above mentioned, the ordinary methods of treatment

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[1] Hebra's formula: R. Olei olivarum optimi, f℥xv ; Lithargyri, ℥iij, ℥vj ; Olei lavandulæ, f℥ij.   The olive oil should first be mixed with two pounds of water and heated over a water-bath ; then, while fresh water is constantly added, and the mixture stirred, freshly sifted litharge should be gradually introduced.   The whole should be kept in motion until cool, and lastly the oil of lavender should be added.   In cool weather, an ounce more of olive oil for every pound of the ointment should be used.

in the acute stages of this affection are of course indicated: namely, the frequent application upon thin cloths of aqueous solutions of lime, carbonate of sodium, or carbolic acid, in the form of evaporating lotions, for an hour several times a day; the use of black wash in the same way for shorter periods, when the parts affected are of limited extent; or the employment of the zinc and lime-water wash above mentioned, sopped on without limit as to frequency. As other and more constant dressings, the powder of zinc and starch may be recommended, to be dusted frequently upon oozing surfaces; and the diachylon ointment, spread thickly upon old linen, and bound tightly upon inflamed surfaces for twenty-four hours, to be renewed as long as the inflammation continues active. By these means an eczema of artificial or extraneous origin may be generally subdued speedily after the exciting cause is removed. Seldom is it necessary to resort to the assistance of internal remedies, if the general condition of the patient be satisfactory. Cooling alkaline draughts, such as those containing the citrate or acetate of potassium, may, if the inflammation be intense or extensive, be occasionally found of service.

Surgical Sequelæ of Eczema.—In another point of view, eczema is an affection of practical interest to the surgeon, as being the cause, directly or indirectly, of cutaneous lesions which require his care, lesions which are the result of tissue changes produced at times by the prolonged action of this disease upon the skin. The most common of these sequelæ is *ulceration* of the lower leg. Eczema of this part, especially after middle life, easily assumes the chronic form, and is accompanied by deep cell-infiltration, so that the integument becomes greatly thickened and indurated. In consequence of the impeded circulation in such diseased tissues, and of the natural feebleness of the blood current in the part, they lose their vitality in great measure, and break down readily into a condition of ulceration. The ulcer may be established by the sloughing of a deep-seated portion of the diseased integument, or by the inability of such infiltrated skin to repair the surface tissues removed by an excoriation, accidental or otherwise. Once established, its size and depth may be limited only by the extent of the prior disease in which it is seated. Its course is always indolent, and it is frequently painful and accompanied by great itching of the surrounding skin. It is, perhaps, the most common variety of ulcer met with in out-patient practice.

Fissure of the anus is another affection which is not infrequently caused by chronic eczema of the neighboring parts. A simple but persistent pruritus is generally the starting point of the affection. This, sooner or later, excites an eczema, as the result of the violent rubbing and scratching which the parts receive, in consequence of which the cutaneous tissues in the vicinity of the anus undergo marked changes. The opposing surfaces, with the cleft of the buttocks, may be intensely red and moist, covered with numerous and deep excoriations, and resembling in appearance the inner surfaces of the labia majora. Thickening and impaired mobility of the parts follow this surface inflammation, defecation becomes difficult, and the anus is practically reduced in size, in consequence of the loss of elasticity in its tissues; and, as the final result, a fissure is formed, generally at the anterior or posterior edge of the opening, which, at first superficial, may extend deeply within the opening and become the usual chronic and painful affection described elsewhere.

Another local form of eczema results sometimes in a grave surgical affection of the part, namely, *epithelioma* of the female breast. Chronic eczema of the nipple is well known to be one of the most stubborn forms of this disease, and a frequent complication of nursing. The disease may occur, however, in the breast independently of this function, even in its virgin state.

The ordinary and diverse appearances of this local variety of eczema need not be described in this connection, but in rare instances, the nipple and areola present the peculiar, raw, red, and oozing phase of the disease for an indefinite period, the epithelium refusing to form anew. All means known in the therapeutics of eczema are tried in vain: no permanent process of repair is established. The part may continue in this state of rawness for years, more or less of the time temporarily covered with a protecting crust or semiformed epithelium, until it is finally discovered that the disease is no longer an eczema, but cancer.[1] This passage of a simple chronic inflammatory condition into a form of carcinoma is not without parallel. The transformation of papillary hypertrophy, in several forms, and of lupus tissue, into cancer, are well recognized examples of such change of character in chronic affections of the cutaneous tissue.

The more general forms of eczema, too, not unfrequently give rise to the development of *furuncles* and *abscesses* which demand surgical treatment. As the result of the long-continued irritation of the skin, and of the consequent violent abuse which, in the form of scratching, it so often receives from the patient in the course of chronic varieties of the disease, it is not at all uncommon for severe furuncular inflammation to occur over considerable surfaces, and to continue for a long time after the primary affection has disappeared. This condition is especially noticed in connection with the artificial eczema of chronic and extensive scabies. Deeper-seated inflammation in the form of small abscesses, too, sometimes accompanies, in children, both acute and chronic eczema, especially upon the scalp. This is rarely observed, however, when the patient is otherwise in good condition, or when the skin has not been long the subject of direct abuse.

ACNE.

Acne only falls within the province of surgery in its more severe manifestations. This follicular or peri-follicular inflammation involves, at times, the cutaneous tissues much more extensively, producing deep-seated infiltration in the form of firm indurations which can be felt beneath the surface, or elevations, varying in size from that of a bullet to that of a small walnut, which last for many weeks, and which disappear either by suppuration and tardy surface discharge, or by reabsorption. Sometimes large tracts of the skin are thickly occupied by such forms of deep inflammation, producing great thickening of such parts, and irregularities of surface. The projecting nodules and tubercles are generally of a dull red or purplish color, and on disappearance are replaced by irregularly shaped depressions or scars, which remain as permanent disfigurements. The parts thus affected are generally the sides of the face and neck, and the back of the neck, although the whole face may be similarly affected in some cases, as well as the upper part of the chest, both before and behind. This form of the affection, called, at times, *Acne indurata* or *inveterata*, may be the termination of any case of common juvenile acne which prolongs itself indefinitely, and may occur in any individual thus affected, though otherwise apparently in perfect health. It affects females as well as males. Occasionally it is associated with general deterioration of health, and may cover extensive tracts of the skin; it is then called *Acne cachecticorum*. In acne of the bearded face, " non-parasitic sycosis," so-called, the same deep-seated follicular forms of inflammation occur.

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[1] Sir James Paget calls especial attention to the affection in St. Bartholomew's Hospital Reports, vol. x., 1874.

TREATMENT OF ACNE. — Against all these graver lesions, the ordinary external applications, which may be generally used with such beneficial results in ordinary acne, are of no avail, and resort to very stimulating or caustic preparations is necessary to hasten the reabsorption of the deep-seated infiltration. In these cases, however, much more expeditious results are generally obtained by the early and free use of the sharp-pointed bistoury. This should be inserted deeply into the nodular abscesses and extensive infiltrated tracts, and numerous openings should be thus established for the evacuation of pus and blood. Cold water fomentations and pressure may be applied to check the excessive hemorrhage, which is sometimes very free, though of advantage to the hyperæmic tissues. To the boggy and more superficial lesions, the curette may often be applied with benefit. This operation should be employed daily, as long as the deep-seated suppuration and great engorgement of the cutaneous and subcutaneous tissues exist, and should be repeated with each new development. In this way the most serious forms of the disease may be, in a comparatively short time, reduced to the ordinary manifestations which yield to simpler means of cure. The exaggerated forms of follicular inflammation, associated with *Rosacea* and *Sycosis*, are to be treated in the same way.

HYPERTROPHIES.

KERATOSIS SENILIS. (Synonyms: *Keratosis pigmentosa*, Neumann; *Verruca senilis*, Hebra and Kaposi.)—Under the term *Keratosis*, Lebert described the hypertrophies of the epithelial and papillary structures of the integument, and the same generic name has been used, in a more restricted sense, by the American Dermatological Association in its scheme of nomenclature, to signify, under the title *Keratosis pilaris*, the heaped-up collections of epidermal cells around the mouths of the hair follicles, ordinarily called *Lichen pilaris*, and the affection now to be considered. Neumann describes it under the name *Keratosis pigmentosa*, but this is not very appropriate, as the increase of pigment, although highly characteristic, is not always present. The term *Verruca*, too, is not correct, as the papillary hypertrophy, the essential element of wart growth, is, in this affection, mainly wanting.

It first shows itself in the form of collections of scales, slightly elevated above the general surface, of somewhat darker color than the surrounding skin, of an irregularly circular or oval outline, resembling in fact, without close inspection, freckles of unusual size and tint. The surface of these spots is sometimes shining and smooth, sometimes dry and covered with minute, lightly adherent scales. They are without sensation, and attract little attention at first, although seated generally, and in greatest abundance, upon the most conspicuous parts of the person, namely, the upper half of the face and the backs of the hands. They may also appear over more extensive areas, the forearms and chest especially. Gradually they become more noticeable by increase in elevation and depth of color, but their development is very slow, and years may pass before they have attained sufficient growth to become troublesome. In their most advanced condition, they present elevations an eighth of an inch above the general surface, consisting of dry, horn-like scales, which vary in color from the faintest yellow to the deepest black, and which may be removed with a little violence by the nail or a blunt-edged instrument, leaving exposed a superficial excoriation, either smooth or exhibiting minute conical elevations, which are enlarged sebaceous glands. Examined by the microscope, according to Neumann, the underlying and surrounding tissues present the ordinary appearances of senile atrophy, and

an accumulation of pigment in granular form about the vessels. The sebaceous glands are often enlarged, and their mouths plugged or obstructed, so that they project above the surface of the skin in the form of wart-like elevations when the overlying epidermal scales are removed. The growths differ, therefore, from the true wart, in the natural condition of the cutaneous papillæ, the mass of the excrescences being composed of horny epithelial cells more or less pigmented. When fully developed they may be a third or half an inch in diameter, and they have generally a flat surface. They may occur singly or in considerable numbers, even upon the face or hands, and they give to these parts a peculiar appearance, suggesting, in connection with the age of the patient at which they attain their fullest development, the corresponding tegumentary changes in the bark of an old tree. They rarely appear before the age of fifty, and are seldom very conspicuous before that of sixty-five or seventy. They are much less likely to develop upon persons who have kept their sebaceous glands and cuticle in proper order through life, by sufficient use of soap, than upon those who have neglected this precaution. When very prominent, they are easily knocked off, so that the hands especially often present excoriated, bleeding surfaces when the growths upon them are numerous. The scales, when reproduced, are then more or less discolored also by the admixture of blood pigment.

The *prognosis* in the case of such simple collections of epidermal scales would naturally seem to be most favorable, and so it is if treatment be resorted to in good time; but the most simple changes in the cutaneous tissues of the face, in old people, are always to be held under suspicion. A wart or mole which has existed through life, a more recent accumulation of sebaceous material or of hardened scales, may eventually be transformed into epitheliomatous disease. So this affection is a very common starting-point of this form of cancer. The transition from this simple epidermal hypertrophy to the more serious new-growth, is unmarked by any striking change in the condition of the part. The patient's attention is finally attracted to the fact that the wart is not as firmly fixed as formerly, or that the tissues beneath are softer or more boggy when it is pressed upon, or that instead of having a covering of dry scales, it is becoming a crust or scab, or that this is enlarging at a more rapid rate, or that the part is no longer without sensation. Seeking professional advice on these accounts, he is told that the disease is no longer the harmless disfigurement which he has so long accustomed himself to, but an epithelioma. Such is the final history of keratosis senilis in many cases; such the beginning of a large proportion of superficial cancers of the face in old people.

Treatment.—In the earliest stages of this affection, it will be sufficient to wash the parts daily with soap and water, to keep under restraint the tendency to accumulation of epidermal cells. Generally the use of a little sweet oil, rubbed into the patch and allowed to remain for a few minutes before applying the soap, will make its removal easier. When the growths are thicker and firmer, and when there is much pigment change, it is well to use upon them, overnight, some fatty material like lard or diachylon ointment, in the form of a plaster, and to rub into them in the morning, on a piece of flannel cloth, some of the strong soaps, like domestic soft soap, or sapo viridis, or their solutions in alcohol. Water is next to be rubbed in until a thorough lather is made, which is then to be washed off. Should any excoriations thus be produced, they may be protected by a patch of diachylon ointment until healed. In this way the ordinary growths may be gradually thinned and made to disappear, but the parts will always require extra care and washing subsequently. If epidermal masses are unusually prominent, or if the sebaceous glands are involved to any great degree, severer measures are called for. Concentrated nitric acid may be bored into the underlying tissues upon

a sharply pointed stick, or the sharp spoon or curette may be used to scrape out at once all diseased elements. As soon as any suspicion of transition to epitheliomatous growth arises, the part should be dealt with according to the rules for treatment in that affection.

CALLOSITIES. (Synonyms: *Tylosis; Tyloma; Callus.*)—Callosities are thickenings of the cuticle in the form of flattened elevations of irregular shape and size, of a translucent, pale yellowish color, and of firm, dense texture. Their surface presents the ordinary markings of the external skin, but with less distinctness than the surrounding parts, from which they rise without sharply defined borders. They are developed by constant or frequent pressure, or by friction, or by contact with over-heated or irritating substances, and they are formed most readily over parts in which the pressure from without is opposed by the counter-pressure of prominent bony protuberances immediately beneath the skin. The appearance of callosities varies according to their seat and the nature of the external conditions under which they are produced. With the exception of the soles and the sides of the feet, where they are of frequent occurrence, owing to the uneven distribution of pressure which is caused by ill-fitting shoes, and to which all classes of persons are liable, their most common seats are the hands of mechanics who constantly use in their work a limited number of tools. Thus the hammer of the blacksmith and carpenter, the awl of the shoemaker, the shears of the tailor, etc., makes each its own peculiar callus, which is easily recognized by its seat and shape. Lighter employments, too, may produce callosities, as the fingers of the type-setter and the player on stringed instruments show. When once formed, they serve as a shield to protect the sensitive parts beneath them, and they last indefinitely, as long as the pressure which excited them is constantly exercised. When this is omitted for any considerable time, they either gradually disappear by the normal proces of epithelial desquamation, or are easily detached as a whole, leaving the cuticle beneath them of its natural thickness. They seldom cause any ill-effects: a slight blunting of sensibility in the parts affected; a diminished freedom of motion, when extensive and seated upon palmar surfaces; or a disposition to form fissures over the flexures of joints, being those ordinarily observed. Occasionally, however, they excite an inflammation of the underlying cutaneous tissues, with attendant throbbing, heat. and pain, followed by suppuration, by which the horny mass is lifted up and finally thrown off.

Treatment.—Surgical interference with callosities is seldom called for, except in case of painful fissures through or suppurative inflammation beneath them. In the former condition, the parts are to be kept covered as constantly as possible with softening dressings, such as diachylon ointment spread thickly upon cloth, warm fomentations, etc. Sometimes the fissure, when deep, can be made to heal only by preventing all motion of the part by strapping it with sticking plaster, so that its opposite walls shall be held in continuous apposition. The corium surrounding and underlying the thickened epidermal structures is often in a state of constant hyperæmia. When to this condition a true inflammatory condition is added, no time should be lost in dividing the thickened epidermal layer above the abscess, and allowing its contents to escape; otherwise the pus may burrow deeply, and give rise to serious disturbances in the part. When the hypertrophy is excessive, the upper layers of epithelium may be frequently shaved off, as in the case of corns.

CLAVUS. (Synonym: *Corn.*)—The corn is also a callosity, or thickening of the horny layer of the epidermis; somewhat elevated above the surrounding surface; of flattened, circular, or hemispherical shape above, extending as a

conical or wedge-shaped mass below the ordinary level of the cuticle, and encroaching upon the corium below. When driven by pressure down upon the sensitive papillary layer, it is evident that the corn must cause pain, and it may in time produce atrophy of the underlying papillæ. Corns, too, are developed by pressure, and generally upon parts immediately above prominent protuberances of bone. The centre of the growth, the part of earliest formation, which forms the apex of the cone-shaped, downward projection of hardened epithelial cells, is called the "core." Corns may be caused by the direct pressure of an ill-fitting boot upon any portion of the surface of the foot in contact with it, or from two opposing surfaces of the skin being unduly pressed together, as in the case of the corns which occur between the toes. It is possible, however, for corns to arise without marked pressure, or spontaneously, as it is said, upon the hands as well as upon the feet. When situated between the toes, the appearance of these growths is quite unlike that of the yellow, horny masses which present themselves elsewhere, being soft, flaccid, and white, owing to partial maceration from the confined moisture of the parts; here they are called "soft corns." All corns are painful upon pressure, the wedge of hardened cells being driven down as a foreign body upon "the quick," and they are more painful when the surrounding and underlying tissues are temporarily distended with blood from overheating, or from inflammation, to which they are liable from oft-repeated irritation. The pain of an "inflamed corn" is excessive when pus is imprisoned beneath the hardened mass.

Treatment.—As corns generally arise from tight or ill-fitting shoes, much may be done for their relief, or even removal, by the disuse of such coverings. Pressure should be taken off from the parts affected, by the use of thick rings of felt. Corns may be softened and soothed by frequent soaking in warm water or saleratus water, when the outer layer of the growth can be removed by scraping, or the whole corn may be dug out with the point of a knife. Softening plasters made of pitch or diachylon are sometimes used for the same purpose. The hardening process, on the other hand, may be often employed with advantage; painting the surface of the corn at bedtime with tincture of iodine, or with a strong solution of chromate of potassium, and removing with a blunt knife the upper layers of the growth thus acted upon, before the next application. Nitrate of silver may be used for the same purpose, especially upon corns situated between the toes, the opposing surfaces here being kept constantly apart by bits of linen cloth dusted with starch powder, or with equal parts of starch and oxide of zinc. The inflamed corn should be treated with caution, by the horizontal position and complete rest of the foot, and by fomentations or leeches, if necessary. Cutting in this condition sometimes leads to serious results, such as inflammation of the bursa which is often found beneath the corn, and the patient may be attacked by lymphangeitis, erysipelas, or gangrene.

HORNS. (Synonym: *Cornu cutaneum.*)—Human horns are outgrowths of epidermal tissue of various shapes and sizes, closely resembling, when they attain any considerable length, the analogous formations upon the heads of some ruminants. Their structure is dense, like the nail; their color is yellow or gray, brown or blackish; their surface is more or less smooth, and marked by parallel, longitudinal grooves; their shape is conical, upon a broad base, or elongated and cylindrical, more or less twisted and bent, and terminating in a blunt or pointed tip. On cross section, they are circular, irregularly oval, or angular, and deeply furrowed. Their maximum diameter may be one or two inches, and their length, in exceptional instances, possibly half a foot. They may be single, or may occur in considerable numbers, and their

seat may be almost any part of the cutaneous surface. They most commonly are found upon the scalp and face, but have in several instances been observed upon the glans penis. Although affecting both sexes mostly after middle life, they occasionally originate between the twentieth and thirtieth years. They are of slow growth, and cause little trouble, except when, on account of their excessive length or situation, they are liable to frequent knocks; in which case they may be more or less detached from their seat, or may even be wholly torn away. When the latter takes place, they are almost always reproduced. Their base is also the seat at times of inflammation and pain from violence to the horn itself. The anatomy of these growths is simple. There are hyperplasy and cornification of the epidermal cells, with more or less hypertrophy of the underlying papillæ; examined by the microscope, the cells are seen to form greatly elongated columns arranged in concentric form around what, as the result of drying and hardening, has become a central tubular cavity, transverse sections resembling the peculiar epithelial grouping in epithelioma. The hypertrophied papillæ are often found extending up into the horn for considerable distances with enlarged vessels, as would indeed seem necessary for the rapid development which these growths sometimes assume. In some cases, the horn may take its origin, not from the papillæ and over-lying surface-rete, but from the inversion of the latter which forms the lining of the sebaceous glands. Thus an old sebaceous cyst may become the starting point and base of a horn. Condylomata and other warty growths may also develop into horns, and the bases of these, in turn, as of other keratoses, may become the seat of epithelioma.

Treatment.—Owing to the strong tendency exhibited by these growths to repeated reproduction after spontaneous or accidental removal, their simple excision by the knife does not result in permanent cure, unless the base or papillary matrix be removed at the same time to a considerable depth. In place of the latter step, it is sufficient and more simple, after pulling off the horn, to thoroughly cauterize the base with caustic potassa or chloride of zinc. If the growth originate from an atheromatous cyst, the walls of the latter are to be dissected out, or entirely destroyed by cauterizing them in the same way.

WARTS. (Synonym: *Verruca.*)—Warts are firm elevations of various shapes upon the surface of the skin, due to hypertrophy both of its papillary and epidermal layers. Several distinct kinds are recognized. The ordinary variety, *Verruca vulgaris*, as it is termed, occurs mostly upon the hands of children, although it may affect any age, and may be met with in other parts of the surface, in the form of flattened or semi-globular elevations, varying in size from that of a mustard-seed to that of a dime. At first of the color of the surrounding skin, and little harder than the same, warts become firmer with their growth, and their surface assumes somewhat the appearance in roughness and color of a callus. As their elevation becomes more marked, the overlying epidermis may disappear, leaving the greatly elongated papillæ capped by hardened, epidermal cells, to project as a group of pointed cones surrounded by a wall of thickened cuticle. This is the "seed wart" of popular language. The interspaces between the points of the papillæ retain the dirt, and allow the wart to assume on this account a diversity of colorings. It may remain in this or any of its earlier phases of development for an indefinite period, and is capable of spontaneous disappearance at any stage. Warts of this kind may appear singly, or in great numbers, and may attain a considerable size with much rapidity. The backs of the hands and fingers, for instance, may present a hundred or more at one time. If left to themselves, they cause no trouble except from their unsightliness, and undergo

no further changes except possibly those of spontaneous involution. If picked, or otherwise treated with violence, those which have lost their protecting epidermis bleed easily from the exposed papillæ, as their vascular plexus is often greatly enlarged. There is no ground for the popular belief that this blood will induce the development of other warts upon parts which it touches, or that warts are in any sense contagious.

Another variety is known as the *filiform* wart, presenting a fringe of fine, elongated, thread-like growths above the common level of the skin, arranged either in narrow lines, as along the free edges of the nails, or in patches of small size, like plush in texture. These are enormously elongated and attenuated papillæ without the protecting rim of epidermis, as in those first mentioned.

The "smooth, flat wart," which is but slightly elevated above the surface, and without abrupt edges; which never loses its protecting epidermis; and which is inconspicuous until late in life, when it becomes rough and possibly pigmented, is the *Verruca plana*.

The *digitate* wart, so called, is situated upon the scalp. It consists of numerous projecting protuberances, more or less tightly pressed together laterally, and appressed or standing out at the periphery as individual rays. These are often quite vascular, and bleed easily when hit by the comb, and are never firm and hard like warts elsewhere. They vary in size from that of a small pea to that of a dime, and they occur singly, or in small numbers only.

These are the true warts, and their anatomy is: first an enlargement of the papillæ and their bloodvessels, and then a hyperplasy of the rete above them, with a corresponding thickening or heaping up of the horny cells of the outer layer of the cuticle. As to their causation we know nothing. Most common in childhood, they appear at any age.

There are other growths upon the skin which are regarded by some pathologists as warts, but which are quite unlike those above described. Among these are the congenital forms (more properly called *Nævus verrucosus*), which are occasionally seen at birth, but which more commonly appear later in life, and generally become more or less pigmented, and subsequently hairy. Such warty nævi occupy at times considerable portions of the surface, and follow in their distribution the tracks of important cutaneous nerves (*Papilloma neuroticum*), causing in some cases great and persistent deformity. The little, elongated, pedunculated growths which are at times attached in such great numbers to the skin, but which are merely duplications or little herniæ of the integument, are sometimes wrongly regarded as warts (*verrues charnues*, of the French). The so-called "venereal warts" (although in no way directly of a venereal nature), the *Condylomata acuminata*, have already been described. Precisely similar growths appear also upon parts which have not been irritated by venereal discharges.

Treatment of Warts.—Warts may be most easily and completely cured by excision with the knife or curved scissors. When they are small and soft, the sharp spoon or curette may be used with advantage. These quick methods, however, are frequently impracticable, owing to the objection of the patient and, at times, the great number of the growths, so that a resort to other measures is often a necessity. Simple means will occasionally suffice, such as painting the growths daily with the juice of milkweed (*Asclepias*), with tincture of iodine, or with a solution of perchloride of iron; or applying to them, when moistened, pulverized chloride of ammonium, etc. The rapidity with which they will frequently vanish under such applications, should cause one not to forget the fact that they will often disappear in the same way without any treatment whatever, as after being "charmed." A great number of caustics may be used for the immediate destruction of warts; among

these may be mentioned: strong sulphuric, nitric, hydrochloric, and chromic acids, and caustic potassa. These substances should be used with great care, to insure that they do not come in contact with the surrounding skin, or destroy too deeply the diseased tissues, especially over joints. Their injudicious use may cause deep scars and permanent deformity. Generally one or two applications will destroy the wart. Glacial acetic acid is much less likely to cause trouble than the substances named, and is generally effective. It, like the others, should be applied to the parts on a pointed stick, but it must be used repeatedly at such intervals, daily if possible, as the skin will allow. When applied to the soft warts upon the scalp, it is always successful, and one sitting is sufficient for their complete removal. It is to be repeatedly applied to the growth, for the space of ten or fifteen minutes, when the wart may be readily scraped off with the stick employed in the application of the acid. The hemorrhage which sometimes ensues is readily controlled by pressure.

DISEASES OF THE NAILS.

The surgical affections of the nails are those which are produced both by inflammation of their underlying and surrounding tissues, and by hypertrophy of their own immediate structures. The nails are often greatly altered in appearance, shape, color, thickness, surface-condition, etc., in the course of chronic inflammatory and other affections of the skin in their neighborhood, such as eczema, psoriasis, lichen ruber, ichthyosis, etc.—the tissue changes which characterize these, affecting in time the formative structures of the nail. More acute inflammatory processes may cause the nails to be shed. None of these conditions, however, demand surgical interference, under ordinary circumstances, and they need, therefore, no special mention here.

HYPERTROPHY.—True hypertrophy of the nail can arise only from hypertrophy of the papillæ, or hyperplasy on the part of the matrix, which is expressed by excessive cell formation beneath. In this way thickening of its structure arises—confined to the base, when the matrix only is diseased—but exhibiting itself at the front or lateral edges, when the papillæ of the corresponding portions of the nail-bed are similarly affected. The nail may thus be thickened equally over its whole extent, or may assume a great variety of strange shapes, elevating itself in the form of conical horns, or projecting with various curves and twists beyond its free edge, which is of great thickness. This latter condition is called *Onychogryphosis*. The nail structure becomes opaque, more or less discolored, hardened in parts, or brittle, and easily splintered. If the top of such a horny outgrowth, overlying the matrix or nail-bed, be removed by the knife, we come down upon the tips of the papillæ, projecting to a considerable height above their natural level, and bleeding easily when wounded. It is by the deposit of epidermal cells around these hypertrophied papillæ, as in the formation of *Cornu cutaneum*, that the enormously thickened nail masses are built up. The progress of the hypertrophy is always extremely slow, and its course proportionally long; indeed, when the papillæ are materially enlarged, the process may be said to be permanent, a healthy nail rarely being formed again. Even should the thickened mass be torn off, it is reproduced, just as the cutaneous horn after a similar accident.

The *causes* of true hypertrophy are not well known. Pressure seems to be an exciting cause, as in the formation of the *callus* (page 619). It is on this account that hypertrophy most commonly affects the nails of the toes, especially of the little and great toes. It is in old people, in whom the epidermal tissues

are readily disposed to overgrowth (*Keratosis senilis*), that the affection attains its greatest development. The effect upon the individual varies with the seat of the hypertrophy. Upon the hands, deformity of the finger tips and blunting of the tactile sense are the chief results, although splitting of the brittle tissue occasionally leads to the formation of painful cracks. Upon the toes, however, a similar degree of deformity interferes with the wearing of proper foot coverings, and pressure leads to inflammation of the underlying or surrounding parts. Lateral hypertrophy, or an increase in the superficial area of the nail, by pressure upon the lateral folds, is one of the causes of that most painful affection, " in-growing toe nail," or *Paronychia lateralis*.

INFLAMMATION OF THE MATRIX. (Synonyms: *Paronychia ; Onychia*.)— Though hypertrophy of the nail-plate is not always the cause of this inflammation of the fold of the nail, yet, however primarily produced, it presses against the edge of the nail, and produces the same painful effect as if the nail itself were absolutely enlarged. In whatever way induced, the fold near the free margin of the nail becomes red and swollen, and at first somewhat painful on pressure. At a later period, the part suppurates, leaving an ulcer which discharges a fetid fluid ; or red, spongy granulations arise, which are excessively sensitive to the touch, and which grow above and over the surface of the nail. The lateral edge of the nail, thus freed from its fold, seems to dip down into the inflamed bed tissues, and causes intense pain when an ordinary boot is worn, especially during walking. The inflammation extends at times along the whole edge, and on both sides, of the toe nail, and occasionally affects all the intermediate tissues of the part, so that almost any motion becomes intolerable.

Treatment.—For simple hypertrophy, without accompanying inflammation, when the deformity is sufficient to seriously interfere with the uses or proper appearance of the foot, or when it threatens to cause inflammation of its surroundings, removal of the offending portion is necessary. Nails which are greatly thickened and prolonged in the form of claws, and those which are elevated like horns, may be trimmed down to their normal dimensions with strong scissors, with a fine saw, or with the knife, but it must not be forgotten that the elongated vascular papillae extend upwards into such outgrowths to a considerable extent above the general surface, and that they must at times be cut across in the operation. They, too, should be removed as deeply as possible with scissors, and the bleeding surface should be cauterized with the perchloride of iron. In this way the redevelopment of the exuberant nail tissue may be generally prevented. For lateral hypertrophy without thickening, or for incurving before inflammation has been established, the anterior edges of the nail should be frequently trimmed as closely as possible. Blunt scissors should be introduced as far as possible, without causing pain, beneath the nail at either edge, and a cut should be made obliquely backwards towards the lateral fold. The wedge-shaped piece thus cut, should be removed by the forceps. When inflammation is already established, and suppuration or granulation of the lateral fold exists (*Paronychia lateralis*), mere trimming or paring the nail is of little service. Formerly, the entire nail was under these circumstances commonly torn away from its bed, but this operation is unnecessarily severe, as the same radical result may be obtained by removing only a narrow, marginal portion. After etherizing the patient, the nail is divided with a scalpel from its root to its anterior edge, near the lateral border, by a deep incision. The ingrowing portion is then dissected away from the lateral fold and bed, to its extreme root, and removed. [The operation may be readily performed with sharp-pointed scissors, one

blade of which is thrust beneath the nail, which is thus divided by a single stroke. The offending portion is then removed by avulsion.] If the hypertrophy is marked, or if both edges of the nail are inflamed, the opposite margin should be removed at the same time. The inflammation then rapidly subsides, the wound heals by rest, and nearly the whole nail is left to protect the toe.

A painless method of cure which, though slow, is generally successful, is thus described by Kaposi: A little bundle of charpie, with parallel threads somewhat longer than the nail, is cut and laid upon its upper surface, parallel to the lateral fold. By means of a flat probe the mass is now pushed down, thread after thread, between the swollen and inflamed fold and the edge of the nail. In this way the one is separated from the other, since the bundle of lint rests between them, and the painful pressure is thus relieved. The nail furrow is further bedded all about with additional lint, and then a very narrow strip of sticking plaster is wound about the toe from above downwards, in relation to the inflamed fold, so that this is kept drawn away still further from the edge of the nail. With such a dressing, which when properly applied is not at all painful, the patient can put on his ordinary foot covering and go about with ease. After twenty-four hours, the plaster is carefully taken off, and, after a warm foot-bath, the pledgets of lint are removed. Even after this short interval of a day, it will be noticed that the swelling of the fold is considerably less, and that it is by no means as painful as before, and that already a gaping space has formed between it and the edge of the nail. The dressing is then to be renewed, as on the preceding day. The application of the lint is now still less difficult and painful, as the furrow has become more capacious. In this way, by the repetition of the process, the inflammation, swelling, suppuration, etc., will wholly disappear within the space of from two to four weeks. Exuberant granulations, or those which bleed easily, must often be cut off and cauterized, after which they undergo involution and heal. The result is equally favorable whether the paronychia arises as a consequence of a primary inflammation of the fold of the nail, whereby the latter is relatively too broad, or secondarily, as a result of primary hypertrophy of the nail. In the latter case, the lateral margin of the nail must be cut away from before backwards, which may be done with scarcely any pain, if the fold of the nail has been drawn far enough away from its edge by the process described.

[The term *Paronychia* is commonly applied by surgical writers to the affection otherwise known as panaris, or whitlow, and the name *Onychia* given to ulceration of the matrix. A distinction should be made, too, between the simple " ingrowing nail"—which results from mechanical causes, such as hypertrophy of the nail, or the pressure of a narrow shoe—and the form of ulceration which depends upon disease of the matrix itself, and which is perhaps more often met with in the hand than in the foot; the latter is the true *onychia*, or *onychia maligna*, or, when it occurs in the great toe, the "toenail ulcer" of the older writers. It usually occurs in persons depressed in health, and is immediately caused by injury; some of the worst cases which I have seen have resulted from the explosion of fire-crackers. The treatment adapted for " ingrowing nail," whether by packing with lint or cotton, or by excising a segment of the nail, will not commonly prove successful in these cases; a better plan is, after avulsion of the nail, to cauterize the matrix thoroughly with the solid stick of nitrate of silver, or, which is, I think, upon the whole, preferable, to cut the nail short and then apply the powdered nitrate of lead, in the manner recommended by Moerloose, Vanzetti, and Mac Cormac.]

DISEASES OF THE HAIR.

HIRSUTIES. (Synonym: *Hypertrichosis.*)—The natural growth of the hair upon different parts of the body varies in amount according to age, sex, and race. Overgrowth in point of *extent*, may be extremely circumscribed—as upon a hairy nævus or wart—or may be universal; as regards *age*, it may be congenital, or may occur at any time after birth. The hypertrophy may consist in an excessive development of the usual large and long hairs of the scalp, beard, axillæ, and genitals; of the short hairs which cover the general surface; or of the downy (lanugo) hairs upon the face and other parts of the female, which are changed into the strong visible growth characteristic of the male. It is this latter variety of hypertrophy only which demands the frequent aid of the surgeon. For universal hairiness, it may be stated in the beginning, nothing can be done; for the circumscribed forms of hypertrophy, in either sex, connected with pigmented nævi and warty growths, the best treatment, when of moderate size, is excision of the whole growth. When too extensive for such an operation, the hirsuties alone may be treated by the method now to be considered. There is no affection more distressing to a woman than an excessive growth of hair upon the face, none for which she will more persistently seek relief. It may be confined wholly to the upper lip, or to a few sparse tufts or scattered hairs upon or beneath the chin, or to the sides of the cheeks. · The mustache may often be long and heavy, and the side whiskers largely developed, while a full strong beard is very rare, and generally associated with universal hirsuties. Such growths are by no means infrequent upon the faces of girls after the age of twenty, and the great majority of cases which present themselves for treatment to the surgeon and dermatologist, occur between the ages of twenty and thirty. These young women are generally in good health, and the hypertrichosis seems to be in no way connected with any apparent disturbance of the sexual apparatus. Later in life, about the climacteric period, the lanugo hairs are apt to increase in size and depth of pigment over similar parts of the face, but women affected with this form of the disease more rarely seek professional advice. With the growth upon the face, there is often, at all ages, a similar development over the sternum and about the nipples. In addition to the deformity to which it gives rise, the presence of a noticeable beard or mustache is apt to produce a morbidly sensitive condition, which prompts the bearer to shun society, and at times develops into a true monomania. The writer knew a lady who had visited surgeons in all the principal cities of the country, in vain search for one who would consent to flay the whole lower half of the face, for the extirpation of the hair growth.

Treatment.—It is only within a short time that a radical method of cure for hirsuties has been known. There were previously but three well-known means for the removal of hair, which could be advised by the surgeon, and these had already, in the majority of cases, been resorted to by the patient. They were not only temporary in their action, but they were often of positive injury. The first of these was the method resorted to by persons of the male sex for the temporary removal of the beard, viz.: the use of the *razor*. The second was the application of *depilatories*, which destroy the hair a little way within the mouth of the follicles, and which therefore retard the reappearance of the growth a little longer than the razor, which cuts it off at the level of the surface. But these depilatories have decided disadvantages; they always, in virtue of their caustic properties, produce more or less irritation or inflammation of the skin to which they are applied, which irritation must tend to the stronger development of the overgrown hairs by feeding

their vitality—just as hirsuties, as is well known, not seldom follows the rubefacient action of a mustard poultice on any part of the body. They most commonly consist of mixtures of quicklime and arsenic, or of sulphides of calcium, barium, etc. An objection common to both them and the razor, is that by the use of either there is substituted for the more delicate and tapering, pointed, primary growth, one which is coarser, and of the same dimensions throughout, and much more conspicuous, and that, when resorted to, the remedy must be used frequently. The third method was *epilation*. The same objection is not applicable to this process, for if the hairs are pulled out " by the roots," which may be easily done, the new growth, which is delayed much longer than after the use of the first two methods, is still tapering and comparatively delicate. Even this process, however, by constant repetition, which is necessary to keep the hirsuties under control, tends to stimulate to some extent the growth in the neighboring follicles. Yet it is the only one which should be recommended by the surgeon as within the power of the patient to use for herself, or as affording any satisfactory measure of relief, although temporary, without aggravating the deformity against which it is directed. For the circumscribed hirsuties connected with papillary and pigment hypertrophy, when this is of small extent, epilation is a sufficient means of relief.

But none of these measures can possibly effect the desired result, the radical and permanent destruction of the growth, as this can be done only by the obliteration of the hair papilla at the very bottom of the follicle. To accomplish this, American dermatologists have, within the last few years, devised and practised various methods, among which may be mentioned the galvano-cautery, applied within the hair follicle ; the attempted introduction of powerful caustics or irritants to the interior of the same ; the mechanical destruction of the papilla by rimming out the cavity of the follicle with a triangular glover's needle, etc. But it may be said of all of these that they are unreliable, and therefore unsatisfactory.

It is to Dr. Michel, Professor of Ophthalmology in the Missouri Medical College, that we are principally indebted for the introduction of a method which is both practical and efficient, viz., *electrolysis*. Its success was first demonstrated[1] in the treatment of trichiasis, and its applicability to general hirsuties has since been most successfully established, especially by Dr. Hardaway, of St. Louis, and Dr. Fox, of New York. The necessary apparatus is a galvanic battery of ten or fifteen cells, supplying a current strong enough to decompose water. An excellent instrument for the purpose is the chloride of silver battery of sixteen cells, made by the " Western Electric Manufacturing Company" of New York. It is very compact, free from danger of spilling, and needs refilling only once a year. In addition, there are required a small sponge electrode ; a supply of the slender steel needles of various sizes, without barbs, used by dentists for extracting nerves ; a proper needle-holder ; and two cord conductors, a yard or more in length. The needle is connected with the negative pole of the battery, the sponge electrode with the positive pole. The needle, secured in its holder, is then to be carefully introduced within the hair follicle to be operated on, as far as the papilla, and held there, while with the other hand the moistened sponge electrode is applied to the skin in the immediate vicinity of the part. At once a frothy material is seen to ooze from the mouth of the follicle, around the needle, the product of decomposition of the tissues in contact with its point. This frothing should be allowed to continue for a few seconds, according to the size of the hair to be destroyed, when the sponge electrode should be removed,

[1] St. Louis Clinical Record, October, 1875.

and the needle then withdrawn. The hair should now be removed with forceps, the ease with which it comes away indicating the success of the operation. Should the removal require any force, the needle should be again introduced within the empty follicle, and the process of electrolysis repeated. A considerable amount of pain is experienced during the passage of the current through the tissues, which ceases almost entirely on the removal of the sponge. Sometimes, in addition to the frothing, the skin surrounding the needle is thrown up into an urticarial elevation, and is greatly reddened. Subsequently the follicle may suppurate, or may give exit to a serous discharge, which forms a crust, adhering to the skin above it for a week or two. Sometimes a hard infiltration may be felt beneath the surface for a considerable period. Ordinarily, the after-effects are very trivial. The parts finally return to their natural condition, leaving possibly a minute pit or depression to indicate the seat of the operation. If this has been successful, the hair does not reappear. The degree of success depends largely upon the skill of the operator. Dr. Michel claims that 90 per cent. of the larger hairs are at once and permanently destroyed, but others are satisfied if 50 per cent. are successfully dealt with on the first trial. The operation must be repeated upon those hairs which reappear until all are finally destroyed.

It is a question whether or not the hair should be extracted before inserting the needle. Where the hair is very coarse, so that the mouth of the follicle is well defined after its extraction, it may be better to remove it before inserting the needle; but when the hairs are fine and blonde, their presence is necessary to guide the needle within the follicle to be destroyed. It is easy to make the fine-pointed needle enter the follicle even when the hair remains, and the skilled touch recognizes at once when it has been successfully inserted. Even when the needle cannot be introduced directly within the canal, its point may be made to penetrate the tissue in the immediate vicinity of the papilla, so that the electrolytic action may extend to and comprise this essential point. The subsequent non-resistance to the forceps during extraction shows whether this result has been obtained. In place of the needle, a fine flexible platinum wire, sharply pointed, may be used, as more likely, perhaps, to follow the direction of the hair follicle. The patient should be placed in the strongest available light, but, even under the most favorable conditions, the eyes of the operator will tire after a sitting of an hour or less. Perhaps forty or fifty hairs are as many as can be destroyed at one time with advantage either to the surgeon or to the patient, although the latter, after the first few sittings, generally bears the pain of the process without flinching. When an extensive hirsuties is to be treated, a long time is required for the successful primary removal of the hairs, and some of the follicles will without fail require a repetition of the operation. The fine downy hairs which occur either alone or interspersed with the stronger growth, should not be interfered with until they attain a more conspicuous development.

ELEPHANTIASIS ARABUM.

(Synonyms: *Pachydermia; Bucnemia tropica; Spargosis; Hypersarcosis; Morbus Herculeus; Elephantopus; The Rose; Barbadoes leg; Cochin leg,* etc.)

This Elephantiasis of the Arabian medical writers is in no way related to that of the Greek writers (*Elephantiasis Græcorum*), or true *leprosy*. It affects principally the lower extremities and the genital parts of both sexes, and in both forms is of common occurrence in the tropical and subtropical regions of either hemisphere, though, as a rare affection, it occurs in all parts of the

world. It may also affect other parts of the body, such as the cheeks, upper extremities, ears, female breasts, etc.

In the *leg*, the disease first shows itself as an erysipelatous inflammation of the part, with swelling of the nearest lymph glands, and general febrile disturbance. The lymph vessels also are tender, and may occasionally be felt as hard cords extending up the leg. The temperature of the part is raised. In consequence of the inflammatory obstruction, lymph and serum are effused, and permeate the cutaneous tissues, giving rise to œdematous swelling. After a time these manifestations disappear, and the part returns apparently to its natural condition; but generally a slight thickening and hardness in the integument remain behind. Sooner or later, another attack of erysipelatous inflammation comes on in the same part, and runs the same course, leaving the skin more decidedly and permanently changed. After a few such attacks, the limb generally begins to assume the unmistakable external appearances of elephantiasis. The local erysipelatous attacks continue, but they are less periodic, and are unaccompanied by general febrile action, while the growth is constantly progressive. The thickening generally begins in the subcutaneous cellular tissue, but it may be at first largely confined to either the upper or lower layers of the corium, the outward appearances of the disease varying greatly according as the superficial tissues of the skin are affected or not. When these escape, the surface may appear perfectly smooth and shining, even if pushed up by large nodular growths beneath it. On the other hand, the papillæ may be enormously elongated, resembling the surface of warts or even the bristles of a brush, or forming large papillomatous tubercles. The pigment cells of the rete may be so largely developed as to give a brown or black color to the surface, or the outer layers of the epidermal cells may accumulate to as great an extent as in Ichthyosis cornea. With or without these surface alterations, the essential change in the cutaneous tissues goes on in the deeper parts, viz.: a true hypertrophy of its fibrous elements in the corium and subcutaneous structures. A section through these enormously thickened parts—the skin yielding sometimes clean cuts of four or five inches perpendicular measurement—shows a firm, white, lardaceous looking substance, permeated by serum and lymph. Interposed between the meshes of new fibrous tissue, of which the mass is mainly composed, connective-tissue cells are found in abundance. The cutis is firmly united with the subcutaneous tissues, the normal anatomical boundaries being obliterated. The bloodvessels are enlarged and their walls thickened. The disease affects also the connective tissue around and within the underlying muscles, and, in advanced cases, penetrates to the periosteum. The muscles are found in a state of fatty degeneration and their fasciæ are greatly thickened. In connection with the hypertrophy of the periosteum, new bony material is largely formed, and in this way anchylosis of contiguous bones and of the joints is produced. Thus the disease goes on for years, until the leg may attain enormous dimensions, measuring in circumference, in some cases, 36 inches below the knee and 57 inches at the thigh, and giving rise to a variety of secondary processes. The enormous folds of skin, separated by deep sulci, may by friction become the seat of an eczematous condition; or a true erysipelatous inflammation of the integument may ensue. Ulcers, abscesses, gangrene of the parts may arise; a great and persistent flow of lymph may weaken the patient; the nerves may be so pressed upon as to cause severe neuralgia; disease of the bones may develop; or the great weight and discomfort caused by the tumor may of themselves reduce the patient's strength.

Upon the *genitals*, the progress of the disease is unaccompanied by the characteristic, paroxysmal, inflammatory symptoms which, in its early stages, it presents upon the legs. It begins insidiously, most commonly in the clitoris

or scrotum, or it may affect primarily the labia or penis. The scrotum, especially, is gradually converted into an enormous tumor, which hangs down below the knees, drags down the skin of the abdomen and inguinal region in the form of a narrow pedicle, and buries the penis within its mass, the position of the latter organ being recognized only by a funnel-shaped canal which leads into the mouth of the urethra, and through which the urine finds its passage to the surface. Such growths have been removed, weighing in some instances as much as 165 pounds. The clitoris, too, attains in this way enormous dimensions, hanging down as a globular mass below the knees. The newly formed connective tissue is much softer in the genital varieties than in the crural, and the disease has here been called *Elephantiasis mollis*, from its gelatinous appearance on section.

Another variety of the disease is called *Elephantiasis teleangiectodes*, *Dermatolysis*, or *Cutis pendula*. The skin of considerable portions of the body appears to be too large for the part, and hangs in folds, or in globular masses. Such dependent flaps may feel hard, or soft, and are partly compressible. These hypertrophies, or new-growths, as they are variously regarded by anatomists, are said to be always congenital, and to consist primarily of vascular and connective tissue; they may remain of their original size and character through life, or may develop into elephantoid hypertrophy of the integument, and may extend over large surfaces of the body. They are occasionally observed hanging down from the whole length of the arm, like the dewlap of a cow, and depending from the shoulders and back. The parts to which they are attached are frequently atrophied. According to the preponderance of the vascular over the connective tissue, these growths assume the character of the "vascular spongy tumor," or "cavernous blood tumor," on the one hand, or of the firmer *Molluscum fibrosum*, on the other. In addition to the hard and gelatinous connective tissue which forms the bulk of the tumor, with the new development of bloodvessels, greatly dilated lymph spaces enter into its structure.

CAUSES.—The causes of Elephantiasis Arabum, occurring as an endemic affection, are not known, although many theories have been offered in explanation; among these, the latest, which has recently been advanced in India, is that the disease is due to the presence in the circulating fluids of filariæ, which are supposed to be introduced within the vessels through the agency of mosquitos. Any condition which tends to develop a chronic œdema, will favor the production of this affection. Therefore, in elephantiasis of the leg, varix, chronic eczema, disease of the bones of the part, or any chronic inflammatory process, may be an important factor in sporadic cases, but in the genital forms of the disease, the whole process seems to be passive and inexplicable.

TREATMENT.—The objects to be accomplished in the treatment of *Elephantiasis cruris* are : to prevent the attacks of recurrent erysipelatous inflammation, in the early stages, and to remove the chronic œdema which furnishes the nutritive elements for the hypertrophied tissues. The possibility of effecting a radical cure by ligation of large, afferent, arterial trunks, or the propriety of removing the part by amputation, may also become a question for consideration. The inflammatory attack should be treated by absolute rest of the limb, in an elevated position, and by the use of evaporating lotions, or of warm fomentations. After its subsidence, gradual compression of the hypertrophied part with bandages should be undertaken. These should be applied in the morning, before the patient leaves his bed, beginning with the foot

and proceeding upwards beyond the extent of the swelling, using as much force as can be borne without pain. At times it is necessary to treat an incidental eczema upon the surface, or ulceration of the integument, before compression can be properly employed. More favorable results are to be expected from the use of the rubber bandage than were obtained before its introduction, because it can be readily applied by the patient himself, and because it continues to exert its constricting action throughout the day, whereas bandages made of other materials become relaxed in a few hours, and must be readjusted several times during the day to be of service. By the use of the elastic bandage the size of the limb may be gradually reduced to a considerable extent, the progress of the disease checked, and locomotion made much easier. It of course cannot be laid aside except during the night, and must be worn through life. As a radical measure of relief, ligation of the femoral artery has been performed in numerous cases; first by Dr. Carnochan, of New York, in 1857, and since then by surgeons everywhere. The shutting off of so large a supply of nutritive fluid as this operation effects, with the long consequent rest of the limb in a horizontal position, reduces its bulk of course, but, as the collateral circulation is in process of time established, and as the leg is used, the disease renews its activity, and the part may grow to exceed its former dimensions. An analysis made by Wernher of the results of this operation upon large arteries, in 32 cases, showed in all an immediate reduction of the size of the limb, but the relief was permanent in three cases only. Compression of the main artery is attended by similar results. [Leonard, of Bristol, found that of 69 operations, 40 ended in recovery (3 of these after digital compression of the artery); relief was afforded in 13 more; and only 16 were entirely unsuccessful.] Dr. Morton, of Philadelphia, has tried[1] nerve section in a case in which ligation of the femoral artery had been performed two years previously without permanent benefit. An inch and a half was cut out from the sciatic nerve at about the middle of the thigh, and the operation was followed within six weeks by a reduction of eight and a half inches in the circumference of the limb. Amputation has also been resorted to in many cases, but the results have generally been unfavorable.

In *elephantiasis of the genitals*, compression is impracticable, but excision is generally successful. The enormous pendent growths met with in the female organs are easily removed by simple amputation. When the scrotum is affected, the following directions for a plastic operation, given by Pruner, as quoted by Kaposi,[2] may be followed. In case the penis is still free, the patient having been placed in position for lithotomy, "whereby the tumor is properly supported and the penis bent backwards, above, two lateral, semilunar incisions are made from the end of the scrotal raphe, where it is in contact with the root of the penis, towards the margin of the anus. These incisions mark out the two oval flaps which, when carefully dissected up, form the artificial scrotum. After these two flaps have been made, the testicles and the spermatic cords are freed by downward cuts, on each side, at right angles to the flaps, and by careful separation of the tissues beneath; and any existing complications, as hydrocele, for instance, having been removed, then the portion of the tumor attached to the perineum is carefully and thoroughly excised, when the whole mass of the tumor falls away. . . . . The testes and spermatic cords, which, in the mean time, have been wrapped up in a warm cloth, moistened with mucilage, and placed upon the abdomen, are now brought down and inclosed in the two lateral flaps, which are brought into

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[1] Philadelphia Medical Times, January 19, 1878, and Surgery in the Pennsylvania Hospital, p. 118. Philadelphia, 1880.
[2] Hebra and Kaposi on Diseases of the Skin (New Sydenham Society's edition), vol. iii. p. 157.

the closest apposition, and retained there by means of stitches, sticking plaster, etc. . . . . If, however, the penis has already become buried in the tumor, then the operation undergoes several modifications. These are the formation of an oblong, quadrangular flap of reserve to cover the penis, the formation of two oval lateral flaps . . . . to form an artificial scrotum, the removal of the pouch formed by the orignal covering of the penis, the separation of the testes and spermatic cords from the surrounding mass, etc." Dr. Osgood,[1] of the Foochow Hospital, reports sixty successful operations of this character in China, many of the tumors having been of enormous size. [Of 28 cases operated on by Fayrer, 22 ended in recovery and 6 in death: one from shock, and the remainder from pyæmia. The same surgeon, from an analysis of 193 cases, gives the general death-rate of the operation as 18 per cent. To diminish bleeding during the operation, the part should be elevated for some hours previously, and the neck of the tumor should be compressed with a clamp (Fayrer), a running noose (Mactier), or an Esmarch's tube as employed by Partridge and Cayley, of Calcutta.]

In *Elephantiasis teleangiectodes* the vascular growths may be treated in their early stages as large nævi, according to the ordinary rules of surgery; when, however, they are of any considerable extent, but little benefit can be obtained from any method of treatment.

ROSACEA HYPERTROPHICA.

Closely allied, in its most advanced stages, to the elephantiasis above described, is the affection commonly called *Acne rosacea*. This title is not a good one, because the acne often found associated with the affection is not an essential part of it. This is a chronic disease of the integument of the face, characterized by redness, by enlargement of the capillary vessels, and by hypertrophy of the cutaneous connective tissue, in the form either of prominent elevations, or of general thickening of the skin. The seat of the disease is principally the nose, but it may extend to the chin, cheeks, and forehead, and, in rare instances, to the scalp. The first evidence of its appearance is a redness, a chronic blush, as it were, of the end of the nose, which Hebra well describes as looking as if "frost-bitten." At a later period, there will almost always be associated with this redness an enlargement of the superficial capillaries of the nose and cheeks, appearing as a network of bright-red vessels. In this form, the disease is a frequent affection, in greater or less degree, with women, and more so than that which is accompanied by development of true acneiform inflammation of the follicles, and by seborrhœa. The redness varies in degree and tint, according to the temperature, the time of day, the condition of the patient, etc., being sometimes of a fiery scarlet, and at other times of a livid, purplish hue. This condition may last indefinitely, and may never progress to the more advanced forms of the affection. In the second degree, firm, nodular elevations, varying in size from that of a small to that of a large pea, are developed upon the hyperæmic skin of the nose and cheeks—which are themselves red—and may soften and be resolved, or may terminate in permanently organized protuberances. In the highest degree, and after long continuance of these earlier forms, the affection presents more prominent outgrowths from the surface of the skin, varying in shape or size, and elastic to the touch ; or the tip of the nose or the alæ may take on a similar hypertrophy ; or the whole organ may develop to an astonishing size, justifying the expression in common use in Germany—"pound-nose."

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[1] Medical Record, April 8, 1876.

If to this enormous thickening of the integument we add the fiery hue which accompanies it, especially in free drinkers, the enlarged and visible capillaries, the widely distended follicular openings, and, to complete the picture, the numerous comedones, acne pustules, seborrhœa, and scars, we have the immortal nose of Bardolph, as painted[1] by an artist whose descriptions of all things within the compass of his observation have never been equalled.

NATURE AND CAUSES.—The *nature* of the anatomical changes in rosacea is primarily an enlargement and new growth of the vessels of the skin, in its upper portion, and subsequently, hypertrophy of the connective tissue, which, at first jelly-like and elastic, and capable of reabsorption, becomes, in the most advanced forms of the affection, fully organized and firm. We have little positive knowledge of the *causes* of rosacea. In the first stage, it occurs about equally in both sexes, but in its most advanced forms, it affects almost exclusively men beyond middle age. It is often associated, in women, with disturbance of menstruation and with anæmia. Constant exposure to rough weather favors the development of the vascular new growth. That the free use of alcoholic drinks works strongly in the same direction, has been recognized in all ages, as seen in the Latin poets, in the tavern talk of Falstaff and his companions, above referred to, and in the expressions " toddy" and " grog blossoms," in use to-day.

TREATMENT.—The mild grades of the affection are best treated by such local remedies as are of service in the hyperæmia and follicular inflammation of acne. For the diffused redness, a wash of sulphur and camphor (Sulphuris præcipitati ℨss, tincturæ camphoræ f℥ss, alcohol f℥vij), applied freely at night, will often gradually give relief, if used in connection with remedies addressed to any general fault of the economy which may exist. The enlarged vessels which ramify so conspicuously just beneath the epidermis, may be destroyed by repeated scarifications with a sharp-edged needle, or much more surely by electrolysis. The nodules, in their earliest stage, may be freely lanced, or scarified, or, when too firmly organized to be relieved by depletion, may be removed by the curette. When the skin is greatly thickened, and when the nose has become monstrous in size, either over its whole extent or at its tip or alæ, it may always be reduced to moderate proportions by free excision of the hypertrophied integument. The surgeon must be prepared for free hemorrhage from the vascular new growth. [To avoid bleeding, Ollier recommends the employment of the galvano-cautery.]

KELOID.

Keloid [or Cheloid] is a new growth of fibrous tissue resembling a scar, embedded in or elevated above the skin, arising spontaneously, and generally remaining through life. It has been the custom to divide such growths into the *true* and the *false*, according as the keloid has its origin in the normal skin or in a pre-existing scar, but such distinctions are of little practical consequence, as the growth is the same in both cases. It begins as a flattened and firm, elastic thickening of the skin, or as a slightly elevated prominence of small size, the surface being of a pinkish hue, or paler than the surrounding skin, and covered by a thin, smooth, and shining epidermis. It may be

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[1] King Henry IV., First part, Act III. scene 3. Bardolph had then borne his nose eighteen years, according to Prince Hal (Act II. scene 4), and we still find it a conspicuous object in the reign of Henry V.: " all bubukles, and whelks, and knobs, and flames of fire."

slightly painful on, or independently of, pressure. It grows very slowly, some-
times spreading itself out as a thick, firm plate, with sharply defined edges,
embedded in the skin, and movable with it; sometimes rising above it as a
bean-like prominence, several lines in height; sometimes sending out ridge-
like prolongations from its central mass into the surrounding skin, and pre-
senting the most varied shapes. Years are ordinarily required for its fullest
development, and it may attain the size of the palm of a hand. It is, possi-
bly, capable of self-involution, but it never undergoes any other anatomical
change, nor exhibits any surface lesions excepting the thinned, smooth epi-
dermis, mostly devoid of hair. Its seat is most frequently the anterior tho-
racic region, the neighborhood of the sternum particularly, but it may occur
on any part of the surface, especially when it arises from pre-existing scars, such
as those left behind by acne, leech-bites, etc. Generally single in its develop-
ment, keloid may occur in numerous patches, as many as twenty or more.

Of its causes, nothing definite is known, observation merely showing that
some persons are so prone to the formation of this new growth, that any in-
jury to the skin becomes the seat of its development. The black race is
especially disposed to it, the growth attaining an enormous size, in some in-
stances, upon the seat of former injuries to the integment. Anatomically,
keloid is found to consist of dense fibrous-tissue new growth, arranged in
direction parallel to the surface of the skin. It starts with the development,
about the arteries of the corium, of spindle-shaped cells, which become finally
fibres. These increasing, make the bundles of fibrous tissue, which press
upon, and finally obliterate, the vessels and glandular structures of the skin,
until its whole substance is converted into dense fibrous tissue. In the out-
lying portions, the early development of the new growth may be always
studied in the adventitia of the vessels, extending into the apparently healthy
structure of the skin to a considerable distance beyond the mass of the tumor.
The superficial tissues of the corium, the papillary layer, remain unchanged.
In the so-called "false keloid," arising from pre-existing scar tissue, that por-
tion of the growth which occupies the seat of the former cicatrix, is of course
without the papillary bodies, superficially, inasmuch as they must have been
destroyed in the preceding destructive process; but the remainder of the
growth, extending from the original scar as a centre, presents no differences
from keloid of spontaneous development. Microscopic investigations of the
structure of the starting-point, minute it may be, of the growth, would be
the only means in many cases, therefore, of distinguishing one clinical form
from the other. From hypertrophied scar tissue proper, keloid is distin-
guished not only by this absence of the papillary structure, but also by the
want, in the former, of parallelism in the arrangement of the fibres, which
run in all directions.

TREATMENT.—Although keloid is not destructive of life or of cutaneous
tissue, it is an affection which may be called in one sense malignant, inas-
much as it is incapable of cure, and will return repeatedly after excision. It
would be useless to call attention to the various remedies which have been
advised by writers to check its progress or cause its involution, for no evi-
dence exists that they are capable of exerting action in either direction.
Neither is the destruction of the growth, by caustics, or its most careful and
apparently complete extirpation by dissection, of avail; the scar tissue which
necessarily results always forming a starting point for the re-development of
the fibrous-tissue new-growth, which must be pronounced incurable. The
only treatment possible, lies in the direction of relief to the pain and itching,
which in many cases accompany the disease, especially during its period of
active growth. For this purpose, it may be protected from contact with the

air or clothing by the application of soothing plasters, and, in severe paroxysms, subcutaneous injections of morphia may be employed. Generally, however, the patient must be content to bear his affliction without hope of surgical relief.

Hypertrophied Scar.

The hypertrophied scar may be developed as the immediate sequence of a preceding destructive process, in consequence of protracted cicatrization by which the granulations have time to become organized into firm fibrous tissue, and to thus form well-marked tumors of various shapes—nodular, stellate, reticular, band or ridge-like, etc.; or flat and normal scars may, at some considerable period subsequent to their formation, take on a like hypertrophy, and be transformed into similar disfiguring tumors. Such results, although more likely to follow the destructive action of certain agents upon the cutaneous tissues, may ensue upon any injury to the skin, even the simplest incision, for reasons wholly unaccountable. Such overgrown cicatrices may present a smooth and even surface, but slightly elevated; or ridge-like tumors of great extent and prominence, with pockets and bridles, and of frightful appearance. Their structure differs from keloid growth in several respects, the bundles of fibrous tissue, of which they are composed, running in all directions, so as to form a complex network of slender and broad bands. The papillary layer above is wholly wanting. The bloodvessels are very abundant in the early stages of the growth, but are in old scars no longer pervious.

Treatment.—Unfortunately, very little can be done to relieve the disfigurement produced by hypertrophied scars, urgently as patients may request the aid of the surgeon. In exceptional cases, excision followed by a plastic operation, may effect a cure; but excision is almost always followed by the formation of a still larger scar, in consequence of the greater loss of substance, and no certainty can be given the patient that a similar hypertrophy of the new scar may not result. Should there be any keloid element in the original cicatrix, such a result would be inevitable.

Fibroma.

(Synonyms : *Molluscum fibrosum ; Molluscum simplex ; Molluscum non-contagiosum.*)

This form of Molluscum differs from Molluscum contagiosum in possessing no outlet, nor contents which can be squeezed through such an opening, for it consists of a new growth of connective tissue. It may occur singly, but is often observed in great numbers. In size it varies from that of a pin's head to that of filbert, an egg, or a fist; or may form even larger tumors. In shape it may be flattened, semi-globular, prominent, and attached by a broad base, or may become in time pedunculated. The integument covering it is generally unchanged in appearance, but may be somewhat hyperæmic, and, in rare instances, has been known to ulcerate when the tumor was large and pressed upon on account of its position. The follicles upon the surface are sometimes enlarged and plugged by hardened sebaceous matter. The growth feels somewhat soft and elastic on pressure, or of variable hardness in different parts, when large. The seat of these tumors is by preference the trunk and upper parts, but they may occur upon any part of the surface, including the scalp, and may cover nearly the whole integument. They develop, too,

within the cavity of the mouth. They begin to show themselves in the majority of cases early in childhood, although they rarely attain any considerable size until adult life. They are capable, when small, of spontaneous involution, leaving a purse-like fold or projection of the skin to mark their former seat; but ordinarily they persist through life, continuing to increase in size indefinitely, or ultimately ceasing to grow. They give rise to no subjective symptoms, and are merely an inconvenience and deformity. The growth consists in its early stage of new connective-tissue cells, which seem to have their origin from the lower layers of the corium, or from the meshes about the fat-cells, and which have a jelly-like softness, but gradually become firmer, until in old tumors they are found converted into firm bundles of fibres. They possess few vessels except at their base. In their anatomy, therefore, they are closely allied to Elephantiasis Arabum. Fibromata, however numerous, have no effect upon the general economy, nor do they undergo malignant degeneration. They may develop even in great multitudes upon persons otherwise perfectly sound.

TREATMENT.—Nothing can be done to arrest the development, or to cause the reabsorption, of fibrous molluscum by external or internal remedies. The only question is of removal by surgical means, and this is not called for except when the growths are very disfiguring, as upon the head, or incommodious from position or size. When small or appressed and crowded together, they may be scraped away with the sharp spoon or curette, but when of larger size, they must be excised, if their base is broad; or they may be removed also, if they have a slender or peduncular attachment to the surface, by the galvano-cautery or by the ligature. No serious results follow such operations.

XANTHOMA.

(Synonyms: *Xanthelasma; Vitiligoidea; Fibroma lipomatodes.*)

This is a peculiar condition of the skin, characterized by sharply defined patches or elevations of a yellowish color. Two varieties are recognized by dermatologists: *Xanthoma planum* and *Xanthoma tuberosum*, but they are not distinctly defined. The first, or flat form, occurs chiefly about the eyelids, in the shape of elongated patches, but slightly elevated above the general surface, varying in tint from a pale lemon to a brownish-orange, and in size from a minute point to an inch in length, and a quarter or half inch in width. The skin thus affected feels perfectly normal to the touch, or when pinched up, and its sensations are in no way changed. The surface is smooth and even. These patches occur most frequently upon the eyelids, or upon the nose near the inner canthus, but they may affect other portions of the face, such as the ear, or the neck and the mucous membrane within the mouth. The tubercular variety appears in the form of yellowish papules or nodules, of the size of a pin's head, pea, or bean, or somewhat larger, sharply defined, and not projecting to any great extent above the general surface. These, too, are smooth and soft, and of the same color as the patches of the flat form, with which indeed they sometimes occur simultaneously, or the flat variety may in rare instances develop into the tubercular. The most common seat of the latter is on the fingers and toes, the palms and soles, and the penis. It may occur upon any part of the body. Both forms begin insidiously, increase very slowly, and last generally during life. They are rarely seen in childhood, and more commonly in women than in men. Of the causes of Xanthoma, little or nothing is known. English writers have associated it with a previous history of jaundice in the patient, but in the majority of cases no

such coincidence exists. It is noticeable, however, that in many cases the skin about the eyes in women thus affected is very darkly pigmented, making the light yellow patches of xanthoma more conspicuous. The structure of these growths has been variously interpreted by different observers. Virchow considers them connective-tissue new growths, the cells in the central portion of which have undergone fatty infiltration, while the outer are free from fat, and resemble sarcoma. Kaposi regards them as interstitial new growths of fibrous tissue, with deposits of yellow fat. Geber and Simon, recent observers, maintain, on the other hand, that the growth is a hyperplastic development of the cells of the sebaceous glands proliferating into the fibrous tissues. The *diagnosis* between xanthoma and milium is easy, for nothing resembling the contents of the sebaceous glands can be squeezed from the patch, by incision, as in the latter affection.

TREATMENT.—The growths may be removed, if the patient desire an operation, by the curette or by incision. Owing to the loose texture of the skin about the eyelids, large patches may be easily removed by dissection, and the edges of the wound brought together without subsequent deformity. Care must be taken, however, not to go more deeply into the underlying tissues than is necessary, for fear of possible ectropion. The growths, however, may be safely left to their own course, as they never give rise to anything more serious than disfigurement.

NEUROMA.

This is a name which should be properly applied here to new growths of nerve tissue in the skin. It may perhaps be doubted if such, strictly speaking, occur. Cases have been described of small, multiple, tubercular masses of slow growth, situated in and rising above the skin, which eventually became the seat of intense paroxysmal pain, and which were very sensitive on pressure. The tubercles varied in size from that of a small pea to that of a filbert, were firm and elastic, and sometimes of a pinkish color. They were composed of connective tissue, with more or less of non-medullated nerve fibre. They were apparently closely allied to fibroma, and to the "painful subcutaneous tubercle," which has its seat beneath the skin. In the two cases above referred to,[1] exsection of the nerve supplying the affected parts was followed by diminution of pain, and by a reduction in the size of the tumors.

ANGEIOMA.

This is a new growth or hypertrophy of the bloodvessels of the skin, which shows itself in a variety of forms, all being included under the same general title. The simplest of these forms, those which arise during extra-uterine life, are called *teleangiectases*. They are enlargements or new growths, mostly of the superficial capillaries, and are observed sometimes as single or branched vascular twigs, of a bright-red, purplish, or bluish color, situated principally upon the nose and cheeks, especially in rosacea; sometimes as circumscribed, circular patches of the size of a pea or bean, consisting of minute visible vessels radiating from a centre, which is occasionally elevated as a small point or papule of a brilliant scarlet hue (the "spider cancer" of popular language); and sometimes as more prominent nodules, which are turgescent and of a reddish or purplish color. Teleangiectases may first show themselves in early

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[1] Duhring's Diseases of the Skin, 2d Edition, page 535.

childhood, but they may appear at any time up to extreme old age. Once developed, they are generally permanent, but the superficial forms are capable of spontaneous involution. Their seat is principally the face, but they occur also upon the neck, breast, backs of the hands, and indeed upon any part of the surface of the body. They may also affect the red border of the lips, and the interior of the mouth.

Nævus Vascularis.—This variety of angeioma is congenital, or becomes apparent immediately after birth. It appears in the form of a diffused discoloration of the surface, varying in tint from a faint pink, through bright scarlet or purple, to a deep indigo, and its size varying from that of a small pea to uniform areas of great extent. The surface may be smooth and even, and but slightly elevated above the surrounding skin, and slightly or not at all turgescent. This is *Nævus flammeus*, *Nævus simplex*, or "*Port-wine mark.*" Another form, more deeply seated and composed of larger vessels, is not so uniformly diffused, but prominent, of uneven surface, tumor-like, and compressible. This is *Nævus tuberosus*, *Angeioma prominens*, or *Angeioma cavernosum*. Both forms generally occur singly, and have their principal seat upon the head, on the scalp, and all parts of the face, are found sometimes upon the trunk and hands, and are seen rarely upon the lower extremities. They are sometimes associated with pigmented and warty nævi. They generally attain a considerable development in the first months of life, and may remain permanently of the size thus acquired. On the other hand, they may take on a more active growth, or may undergo diminution in size, at any subsequent period of life. The deeper-seated forms are especially liable to assume a more active development in later life, extending down into the subcutaneous tissues—muscles, nerves, and bones, even—producing atrophy of the same by pressure of the immense vascular new growth, which becomes converted into a prominent spongy tumor, occupying large districts of the body (see *Elephantiasis teleangiectodes*, page 630).

Anatomically, these growths present great differences in the complexity of their structure. The flat forms of nævus consist simply of an enlargement or new growth of the capillaries of the papillæ and of the upper layer of the corium, with generally some enlarged feeders rising up from the deeper vascular plexus. The variations in their color depend upon the relative predominance of the venous and arterial vessels. In the prominent (tuberosus) forms, not only are the deeper seated trunks enlarged, but the networks connected with the various glandular systems of the skin are implicated, with new development of vessels in the form of pouches and coils, which communicate freely with each other, forming great sponge-like convolutions of bloodvessels, mixed with more or less new growth of connective tissue of the gelatinous kind. In the extreme examples of this sort, we have Elephantiasis angeiomatosa. The true *Tumor cavernosus*, so called, has a much greater development of the fibrous tissue, which surrounds the vascular new growth with a firm capsule, and sends off shoots from the same between the vessels within, forming partition walls and a firm fibrous skeleton to the whole mass, within which the blood flows in great open channels. The precise anatomical nature of such tumors is a subject of active discussion among pathologists. They are generally confined to the internal organs, but may develop beneath or within the skin, rarely attaining the size of a walnut. They are found in the neighborhood of the saphenous and cephalic veins. Their surface may be the seat of various excrescences.

Treatment of Angeiomata.—For the simple teleangiectases, efforts may be made to destroy the tortuous vascular twigs which ramify so near the sur-

face, by cutting across them freely and repeatedly with a knife or cataract-needle, and by applying to the bleeding points a solution of perchloride of iron, or of nitrate of silver in water, equal parts. This process is not uniformly successful. For the dilated vessels, as well as for the circumscribed and minute nodular forms of the disease, the operation of electrolysis is perhaps the best. A fine needle connected with the negative pole is to be inserted into the channels of the vessels, and a current of ten or fifteen cells employed, a sponge electrode connected with the other pole being applied to the skin near by. (See application of electrolysis in hirsuties, page 627.) The needle is then to be inserted at other points until the whole vascular structure has been destroyed. The application of nitrate of silver or nitric acid to the central nodule often fails to destroy the halo of vessels radiating from it. Small and flat nævi may be treated in the same manner as teleangiectases, but attempts to destroy extensive growths of this kind by scarification, as recommended by Squire for port-wine marks, will not often prove successful. Electrolysis and the galvano-cautery are the most reliable methods to employ. For the deep-seated forms, various means of cure have been practised. Compression, ligation of afferent vessels, injections of styptic solutions are of no avail, and the latter method is dangerous. The galvano-cautery repeatedly applied to one part after another, by means of platinum wire, is often successful. If the action is too intense, sloughing of the tissues and possibly hemorrhage may ensue. Only a small portion of the tumor should be acted upon at one time. Vaccination, performed at several points over the growth, may effect a cure by causing progressive sloughing of the vascular tissue. Small nævi may be destroyed by strong nitric acid, or by caustic potassa ; strangulation by ligatures may sometimes be used with advantage, when these can be applied about the base of small tumors ; or the thread may be passed beneath the growth, and tied so as to compress the tumor in several parts. In such cases it may be well, after the separation of the strangulated part, to cauterize the exposed base of the nævus so as to prevent its return. Direct excision, too, may be resorted to, care being taken that an abundance of the surrounding skin is included, so as to prevent peripheral return of the growth. The edges of the wound are to be united by sutures. Spontaneous cure is occasionally effected in infancy, by progressive sloughing or ulceration arising of its own accord.

Cavernous tumors may be readily excised, being easily enucleated with their fibrous capsules. Operations for nævus in infancy may be delayed, because spontaneous involution is possible. Operation at any period of life is only demanded when the growth takes on rapid development ; under other circumstances, it may safely be left untreated.

LYMPHANGEIOMA.

The lymphatics may also undergo enlargement and new growth within the tissues of the skin, and may form multiple tumors of small size, projecting above the surface in the form of oval or semi-globular, flattened papules and tubercles. They are of a dull-red color, smooth and firm, and look, according to Kaposi, who first described this affection, like a papular syphiloderm. The disease in his case appeared in childhood and continued through life. The structure consists of canals and openings, which are enormously enlarged lymphatics. Much larger lymph tumors of cavernous structures may be formed in the subcutaneous tissues and glands, whence they project themselves into the skin.

RHINOSCLEROMA.

This is a very dense cellular new growth, situated in the region of the nose. It consists of flattened or prominent tubercles of very dense structure, smooth, of a dark brownish-red, or of the color of the skin, isolated, or forming by confluence a firm, abruptly defined mass. Deep fissures may occur in the infiltrated integument, allowing the discharge of a viscid fluid and the formation of crusts. The surrounding skin is perfectly healthy. The seat of the growth is the alæ nasi, the septum, or the upper lip just at the edge or within the nostrils, from which points it spreads inwards and outwards, causing much deformity in the shape of the nose and lip. The nostrils, which are greatly narrowed, seem carved out of ivory, and the tip of the nose seems to be converted into a thickened plate of cartilage. The progress of the disease is slow, requiring years for its fullest development. Finally, the mucous membrane of the lip becomes involved, and the nasal openings become entirely impervious, so that the patient is obliged to breathe with open mouth. The cartilage and bone even may become affected. Meanwhile, the tubercles undergo no further change, such as softening, ulceration, or carcinomatous transformation, even after many years' existence. The cause of this strange and rare affection is unknown. It affects both sexes and persons in middle life. On cutting into the tubercles, they are found to consist in their early stages of normal connective tissue crammed with small round cells, especially in the upper layers of the corium. Later, the cell infiltration extends to the deeper structures, forcing apart the fibrous framework, and penetrating even the cartilage. According to Kaposi, who first described and has especially studied the disease, the growth is closely allied to the small celled or granulation sarcoma. Other observers, however, regard it as a chronic inflammatory process. Left to itself, the disease progresses slowly and indefinitely, but produces no more serious results than great deformity of the nasal region, and impeded respiration. It is incapable of spontaneous involution, nor can its disappearance be effected except by its destruction, which may be accomplished either by caustics or by excision.

TREATMENT.—The nostrils may be opened up by boring through the masses of new growth which obstruct them with a stick of nitrate of silver or caustic potassa. The pain and hemorrhage are very slight, and no inflammation follows the use of these agents. Such destruction, however, is always temporary. After some months, the nodules begin to grow again from their base, and gradually attain their former size. The growths which affect the outer parts, or which are embedded in the integument, may be excised, and a plastic operation performed at the same time ; but even after such radical operations the disease may recur.

LUPUS ERYTHEMATOSUS.

This is a chronic inflammatory process, characterized by the formation of slowly spreading patches of redness, with an elevated margin and flattened centre, the surface being generally scaly, and often terminating in superficial scar formation. The disease begins with the appearance of one or more small points, which are red and somewhat elevated, and which slowly increase in size. After a time the centre of the patch sinks to the level of, or slightly below, the surface of the surrounding skin, while the disease progresses peripherally. Thus, after it has attained or exceeded the size of a dime, it

presents a smooth and shining, or scaly, depressed, central portion, separated from the surrounding healthy integument by an annular, elevated border, occupied by the distended or plugged openings of sebaceous glands. This disease may progress thus for many months or years from a single centre, and may cover large areas of skin ; or several patches may coalesce and form a variety of shapes, all sharply defined by the serpiginous border. Its seat is chiefly the central parts of the face, especially the nose and adjoining portions of the cheeks, but it may affect the outlying parts as well, the lips, ears, scalp, fingers and toes, etc. Upon the scalp, it produces bald patches, which are red and shining, and circumscribed by a narrow, elevated border, covered with scales. The course of the disease is generally very slow, a single patch requiring generally several years to reach its maximum development, and terminating, it may be spontaneously, in a flattening down of its border, and the permanent establishment of a thin, superficial scar. The successive development of such areas of disease may prolong the course of the affection over many years.

Prof. Kaposi has described also an acute, disseminated variety of this disease, which may simultaneously affect a large portion of the body, and may be accompanied by grave symptoms, such as painful subcutaneous nodules and swelling of glands, œdematous enlargements of the joints, and deep-seated pains in the bones, with recurrent, erysipelatous and typhoidal forms of fever, which may prove fatal. Such cases are very rare. Commonly, the disease may exist for years confined to a single locality, without complications and without any effect upon the general condition of the patient, its only serious results being the deformity to which it gives rise.

The *anatomical changes* of Lupus erythematosus may show themselves first in any portion of the cutaneous tissues—in the upper layers of the corium and about the sebaceous glands, or in the deeper portions about the sweat-glands—and may extend to all the structures of the skin. These changes consist in collections of small round cells, with the ordinary manifestations of an inflammatory process ; swelling of the bloodvessels ; serous exudation, distending the connective-tissue spaces and the papillæ ; and cell proliferation, producing thickening and redness of the skin, and seborrhœa. The process of involution is characterized by fatty degeneration of the cell elements, by atrophy of the vessels and the glandular structures, and by shrinking of the connective tissue ; in other words, by the formation of cicatricial tissue. Very little is known of the *etiology* of the disease. It generally affects persons in middle life, and is very rare in childhood. It is more common in women than in men. It is sometimes a sequel of Seborrhœa congestiva.

TREATMENT.—Lupus erythematosus is a most unmanageable affection. Internally, those remedies only are of service which may be demanded by the general condition of the patient at the time. By far the most serviceable is cod-liver oil, if given for long periods. Externally, the severer forms of caustics, such as are demanded in Lupus vulgaris, are not called for. Among the most valuable applications are the strong alkalies, German soap and its solutions, carbolic acid, acetic acid, sulphur, tar, iodine, mercurial plaster, and chrysophanic and pyrogallic acids. All of these will work effectually, even rapidly, at times, and again, at other times, they will all fail in any measure to control the disease. It is often necessary, therefore, to try many remedies in a single case. Perhaps the most valuable of those above named, are the following :—

Soaps, used alone or in connection with the others. They should be rubbed thoroughly into the affected parts, on a bit of flannel rag, and should be subsequently rubbed to a lather with water, and washed off. The excoriations

thus produced should be then healed by the use of soothing ointments, when the process may be repeated.

Iodine, in solution in glycerine with iodide of potassium (equal parts), painted over the affected regions with a brush, as freely and often as the resulting pain and inflammation will permit.

Emplastrum mercuriale, spread upon linen and worn for twenty-four hours over the affected parts, and reapplied as often as the skin will allow.

Pyrogallic acid, ℥j–ij to lard ℥j, spread upon cloth and worn for three days and nights, the plasters being renewed twice a day. When the freely suppurating surfaces which are thus produced have healed, the acid may again be used until healthy tissue is obtained.

Scarification and the *curette* have been recommended as efficacious in some cases. Often, with all these remedies at our disposal, and after their repeated trial, in turn, the disease resists our attacks, and may continue indefinitely in spite of them.

Lupus Vulgaris.

Lupus vulgaris, or simply Lupus, is a chronic destructive affection of the skin and the neighboring portions of the mucous membrane, characterized by the presence of nodular masses, which are embedded in the structure of those parts, and which soften, ulcerate, and leave scar tissue behind them. The process begins with the development of minute tubercles, of a brownish or dull red color, which occur at different depths below the surface, either singly or in groups, and which give the skin a spotted or dotted appearance. This, the primary form of efflorescence, very slowly increases in size, until it attains that of a small shot or large pea, and approaches the surface, causing an elevation and thinning of the epidermis above it. It is then to be felt as an elastic nodule, more or less deeply seated in the skin, and projecting above it. This is *Lupus prominens* or *Lupus tuberculosus*. Several contiguous nodules may continue to increase in size, blend with one another, and thus form much larger elevations of the same dull-red color and elastic feel, and of the size of a large pea or bullet (*Lupus nodosus, Lupus tumidus*). Having reached this, their highest stage of development, the nodules may remain unchanged for weeks or months, but sooner or later undergo involution. This is effected in two ways: (1) The tubercle becomes less tense at its centre, or tip, and sinks down, while the smooth and shining epidermis is converted into yellowish-white, or darker colored scales—*Lupus exfoliativus*. The depression or softening (fatty degeneration) takes place very slowly, until, after weeks or months, the tubercle sinks below the level of the skin, the scales disappear, and finally a glistening flattened scar remains to mark the seat of the primary tubercle. (2) By the other process, the softening of the nodule takes place throughout its mass, or suppuration ensues; the protecting epidermis with its scales and crusts is cast off, and a free ulcerating surface is established—*Lupus exulcerans*. Such ulcers are generally round, with slightly elevated margins, and a red vascular base. They crust over readily with the purulent and other secretions of the part, and are capable of healing by healthy granulations and scar formation. Occasionally, the granulations are exuberant, forming papillary elevations, which may terminate in permanent, wart-like excrescences—*Lupus hypertrophicus, Lupus verrucosus*. These two processes, exfoliation and ulceration, may affect the same tubercles at various times, or may involve different parts of one tubercle at the same time. In all cases of long standing, we have every stage of evolution and involution going on simultaneously, so that the whole process may be studied at once. Thus, by the constant development of new nodules by the side of the earlier efflores-

cence, the disease spreads outwards, and slowly invades new areas of healthy skin, until by growth from a single centre, or by confluence of contiguous patches, large districts become affected. It may spread in this way with a broad line of advance, forming variously shaped patches of large extent— *Lupus serpiginosus.*

Upon the mucous membrane, the characteristic nodular development of lupus is by no means as conspicuous or as easily recognized as upon the skin. It presents, however, brownish-red prominences, covered with gray epithelium, or excoriated points which bleed easily. These increase in size, or coalesce, until they form large patches, with an uneven surface which is covered with pale epithelium, or which is fissured, or in open ulceration. In the process of involution, the prominences and thickening subside, and a cicatricial sinking of the tissues succeeds. In some cases infiltration of the submucous structures, with suppuration and abscess formation, takes place. From the skin and mucous membrane, the disease may penetrate to deeper tissues, such as cartilage, tendons, etc. It is doubtful if it affects the periosteum or bones.

Lupus presents a variety of clinical appearances according to its localization. Its most common seat is upon the nose and cheeks. Upon the *nose*, it begins generally in the alæ, and spreads upwards so as possibly to cover the whole organ, producing, in addition to its characteristic tubercles, a considerable degree of swelling and deformity from the thick crust formation which accompanies it. After a time, the alæ are frequently destroyed, either by ulceration, or by atrophy and shrinking through cicatrization. The disease may extend within the nasal openings, from without, or may develop primarily upon the mucous membrane there, where it may exist for years, forming crusts which constantly renew themselves, and which terminate with perforation or destruction of the septum. From the nose, the disease may spread to the *forehead* and *cheeks*, whence, in its serpiginous form, it may extend to the *jaws*, the sides of the *neck*, and the *ears*. It often appears primarily upon the cheek, and may remain for years as a discrete patch, from half an inch to several inches in diameter. Lupus produces great deformity about the borders of the eyelids, mouth, and ears, often destroying large portions of the latter, and occasionally spreading inwards to the tympanum, and producing perforation. About the *eyes*, it may cause ectropion by final cicatrization, or may attack the conjunctiva and cornea. From the *lips*, it may extend inwards to the *gums, soft palate*, and *trachea*, producing destructive ulceration of their tissues, with hoarseness, chondritis, stenosis, etc. Upon the *extremities*, lupus exhibits some of its gravest lesions and sequelæ. Generally of the serpiginous form, in addition to the extensive ravages upon the skin itself, in consequence of repeated attacks of deep-seated inflammation of the tissues about the feet and hands—in the form of lymphangeitis, periostitis, caries, and necrosis—great deformity of the small bones of these parts is produced, the fingers and toes being greatly thickened, widely separated, curved, permanently contracted, and the like. Tegumentary changes, similar to those described under Elephantiasis Arabum, may also in time affect the lower extremities, with disease of the bones and papillomatous outgrowths. In the midst of all these most varied, abnormal tissue-changes, the true lupus process goes on with its primary tubercle and final scar formation, making in all a most complex presentation of disease. To this list of pathological concomitants and sequelæ of the affection in general, erysipelas must be added, with at times adenitis—when the disease is seated in the neighborhood of small glands—and, rarely, carcinoma.

ETIOLOGY OF LUPUS VULGARIS.—Lupus begins almost always in childhood, rarely after puberty. It affects both sexes in nearly equal proportions, but

the female sex rather more frequently than the male. In America it is by no means a common disease, although the mistake is often made of calling any destructive disease upon the face lupus. Its relations to scrofulosis or struma are problematical. With syphilis it has no demonstrable connection. It is neither contagious nor hereditary.

PROGNOSIS.—The course of lupus is always chronic. Beginning in early childhood, it may continue for years confined to a single small patch, or disseminated widely over the surface. It may cease to be active after long or short duration, and after many years, even in old age, may revive. Its effect upon the general system, even when of extensive distribution and long continuance, is very slight. It is capable of local cure in its simpler manifestations, but relapses cannot be prevented.   •

MORBID ANATOMY.—According to Kaposi, whose studies of its tissue changes are the most recent and elaborate, lupus presents in its early stages globular accumulations of small cells, situated between the bundles of fibrous tissue of the corium, beneath the vascular layer; thence the cells follow along the course of the vessels into the papillæ, around the glandular systems, and gradually diffuse themselves throughout the whole structure of the corium. At a later period, the sebaceous and hair follicles undergo atrophy, and perish, and, in the process of involution, the lupus cells themselves undergo fatty degeneration. In the subsequent stages of exfoliation, ulceration, cicatrization, new growth of connective tissue, etc., the anatomical changes are the same as those which characterize similar processes in other diseases.

TREATMENT.—There is no specific internal remedy for lupus, no drug which will cause the characteristic tubercle to disappear, or prevent the recurrence of the disease. When, however, the general system is reduced, or when anæmia or functional disturbances are present, much may often be accomplished, by the administration of medicines, in bringing the tissues into a condition to respond more readily to local measures. The most valuable of these medicines are iron, cod-liver oil, and iodide of potassium. They may be used as long as the patient seems to need their general action upon the economy. The objects to be accomplished by local treatment are the direct destruction of the lupus growth, and the restoration of the skin, as far as possible, to its normal condition. The first object may be accomplished by the use of so-called caustics or mechanical means. Of the former, a great number have been employed, but among them all there is none so serviceable, on the whole, as the stick of nitrate of silver, as it is in itself a tool which may be made to penetrate to the deepest parts of the disease, and as its action, while sufficiently destructive, is never excessive. A stout stick of the pure salt, well sharpened by boring into a wet sponge, or the prepared crayon hardened by a mixture of chloride of silver, is to be fitted into a handle, and then bored firmly into the nodules, whether prominent or bedded deeply in the integument. They are easily penetrated by the sharp point, giving the impression of boggy tissue to the operator. The skin is to be thoroughly ploughed up in this way, wherever the stick is allowed admission. The experienced hand soon learns to distinguish the resistance offered by the normal tissues.

   When the disease is in the stage of exfoliation or in that of ulceration, the scales and crust are to be roughly torn away by the stick, and the surface or underlying softened parts thoroughly bored into. The bleeding may be always readily checked with absorbing cotton, or lint, and a little pressure. This operation is painful, but patients will ordinarily endure it, if the disease

be not very extensive, without etherization. The pain may be mitigated in some measure by first freezing the part. It is not of long duration. The parts cover themselves immediately with blackened bloody crusts, which are to be torn off with the crayon at the next burning, which should ordinarily follow in a few days. The process is to be repeated until all diseased tissue has been destroyed, as shown by the impossibility of forcing the point into the tissues. The scars which follow this method are generally smooth and well formed. Chloride of zinc is used, either in solution, or mixed with starch in the form of a paste (Canquoin's), or with chloride of bromine and chloride of antimony (Landolfi's), but it works upon sound and diseased tissues alike, and has no advantage over nitrate of silver. A favorite preparation in the hands of Professor Hebra, is an arsenical paste (white arsenic, one part; artificial cinnabar, three parts; emollient ointment, twenty-four parts), spread thickly upon linen and applied to the affected region. It is to be renewed once in twenty-four hours, and worn constantly for from two to four days; on the third day it becomes very painful. The advantages of this method are that by it only the diseased tissues are destroyed, the healthy and cicatrized parts being left intact. In no case has Prof. Hebra seen poisoning produced by its use, but he has never applied it to a patch larger than the hand. Vienna paste, and other preparations of caustic potassa, destroy healthy and diseased structures alike. Pyrogallic acid and lard, one part to eight—spread upon linen and worn several days—is often effective in superficial forms of the disease. The galvano-cautery and Paquelin's cautery are both of great service for the destruction of the nodules in their early stage, as well as for application to large ulcerations and outgrowths. These and all destructive agents are to be used repeatedly, until the morbid growths are exterminated and fail to reappear. The mechanical methods of frequent scarification, or multiple punctures with the lancet or bistoury, and the scraping or gouging process with the curette, are of service, especially the latter, although it is frequently necessary to apply caustics after using the spoon. Whichever of the above methods be chosen, it must be used vigorously, *without mercy*, it might be said. Most cases require protracted treatment, and often one after another of all the means at our disposal is called into action, sometimes seemingly in vain. In case of relapses we must begin over again.

Leprosy.

(Synonyms: *Lepra; Elephantiasis Græcorum; Spedalskhed; Der Aussatz.*)

Leprosy is a chronic disease of the general system, showing itself in the form of various changes in the integument and other structures of the body, and terminating fatally after some years. It still prevails as an endemic evil of enormous extent in some countries—Norway, India, China, the Sandwich Islands, etc.—but is distributed also in a less degree over nearly all regions of the globe. In North America, it occurs in Mexico and the States south of it; in Louisiana, South Carolina, and Minnesota; and in New Brunswick. Sporadic cases have been observed in many parts of the United States. After prodomal symptoms of months' or years' duration, consisting of debility, irregular action of the digestive system, and, in some persons, an occasional outbreak of bullæ resembling pemphigus, the disease manifests itself upon the skin in three well marked varieties or types, called the tubercular, macular, and anæsthetic forms.

The first of these, *Lepra tuberosa*, begins with the appearance of red or brownish spots, varying in size from that of a small pea to several inches in diameter, irregular in shape, and situated upon the face, arms, legs, palms, and

soles, singly, or in numbers. The skin in such patches is smooth and somewhat thickened. They may remain in this condition for weeks and months, changing somewhat their shape and size, and may partly disappear. After a time, it may be a few years even, some of the spots become more elevated, and elsewhere real tubercles appear, varying in size from that of a small shot to that of a filbert, of a dull or brownish-red color, shining or scaly, elastic and rather soft to the touch, discrete, or forming by confluence large irregularly shaped prominences. They appear in greatest numbers on the face, especially about the forehead and nose, forming above the eyes thickened areas of skin, which overhang them and give so marked a prominence to this region as to cause the face to resemble that of the lion (*Leontiasis*). The nose, too, becomes uneven, and broadens, and the lips are greatly thickened, so that altogether great facial deformity results. The tubercles appear also upon the mucous membranes of the nose, buccal cavity, and trachea. They affect, too, the conjunctiva and cornea. Upon the trunk and limbs, they show themselves scattered and grouped as prominences and embedded nodular masses. Everywhere they exhibit a sluggish course. Some, after months, are reabsorbed, leaving dark pigment stains; others undergo degeneration and soften, forming indolent, shallow ulcers, which last indefinitely. Over the joints especially of the lower extremities, the destructive process penetrates more deeply, and is accompanied by inflammation of the lymphatics, suppuration of joints, and loss of members, such as the fingers and toes—*Lepra mutilans*. After a time, and before such grave structural changes have taken place, the general condition of the patient shows serious involvement of the internal organs. Frequent exacerbations of fever come on, and diarrhœa, inflammation of the lungs, or cerebral symptoms develop, and either prove fatal or subside to renew themselves in subsequent exacerbations. Thus the disease progresses, sometimes with exceptional rapidity, terminating by death in two or three years, but generally protracted through a period of alternate activity and inactivity, of nine or ten years.

Lepra maculosa, the macular variety of the disease, appears in the form of the spots above mentioned, of a reddish-brown color, or of a yellowish-white aspect, circular or streaked in shape, and with or without infiltration. The red or brown spots (*Morphœa rubra* and *Morphœa nigra* of authors) may gradually become pale in the centre, and finally wholly white (*Morphœa alba*), or the integument may atrophy (*Morphœa atrophica*), or the spots may assume a hard, bacon-like form of infiltration (*Morphœa lardacea*), and subsequently undergo atrophy. The spots more frequently occur upon parts protected by the clothing. Lepra maculosa may pass into the form just described, Lepra tuberosa, or, by assuming its peculiar nervous phenomena, into the third variety, which is *Lepra anæsthetica*. This is characterized by the occurrence of anæsthetic patches of skin, which may develop upon the macular or tubercular efflorescence of the preceding varieties, or upon the seats of bullæ which form a conspicuous prodromal feature in this form of leprosy for months or even years, or which may appear upon portions of the integument previously and otherwise normal. The anæsthesia is at times so complete that a needle may be run into such patches to a considerable extent without the knowledge of the patient. This loss of sensibility is often preceded for a long time by congestion and hyperæsthesia of the parts, and both this excess and loss of nervous susceptibility may frequently shift their position. When the anæsthesia becomes permanent, such spots may become deeply pigmented and atrophied. This atrophy extends to the muscular tissues also, giving rise to changes in the expression of the countenance, and inability to close the eyelids and mouth. The trunks of the brachial nerves are to be felt as swollen and painful cords, and the fingers remain in a semi-flexed condition. The

hairs fall from the scalp and face; the nails and skin become dry; the epidermis is cast off, leaving indolent ulcers; the joints become necrosed, and drop off; or moist and dry gangrene of the feet and hands may cause the loss of whole members (*Lepra mutilans*). In these advanced stages, the general system suffers in serious ways: debility, diarrhœa, reduced heart's action and dementia come on, and the patient finally dies of marasmus, tetanus, pyæmia, or pneumonia, or with typhoidal symptoms, etc. This, the last stage of the anæsthetic form, is generally the termination also of the two other varieties.

ANATOMY OF LEPROSY.—The microscopical appearances of a tubercle in leprosy closely resemble those of lupus growth—that is, small-cell granulation tissue—excepting that it is not so confined to isolated masses as in the early stages, but is diffused throughout the corium, especially along the course of the vessels and about the glandular systems. Subsequently this tissue undergoes degeneration, as in lupus, with the formation of large colloid corpuscles. The nervous structures are the seat of marked changes, the result of chronic inflammatory processes, with thickening of the nerves, small-cell deposits in the neurilemma and between the bundles, and, finally, fatty degeneration of the same with atrophy of the nerve fibres. A large part of the nervous system may be thus affected. The internal organs also do not escape, similar changes being found in the testicles, liver, spleen, kidneys, lungs, etc.

ETIOLOGY.—Of the direct causes of leprosy, it may be said that we know nothing, unless we admit its communication by contagion. It occurs in all parts of the world, irrespective of temperature, moisture, altitude, diet, or any recognized physical conditions. It at one time covered Europe with lazarettos. It is on the increase in some regions, and has shown an activity and virulence, during the last twenty years, in the Hawaiian Islands, equal to that displayed at the time of its most extensive ravages in the middle ages in the eastern hemisphere. We know only one fact certainly: that it is hereditary; that a certain proportion of a leper's children are liable to the disease in after life; but that this development is retarded in the descendants, and that the character of the affection is perhaps mitigated by residence in non-leprous regions. On the other hand, there can be no doubt that in individuals without such hereditary taint, the disease is much more liable to develop in regions where leprosy abounds—that is, where lepers live—than in other localities. This suggests the possibility of contagion by direct or indirect personal contact. Certainly, a study of the spread of the disease in the Sandwich Islands, a virgin soil for such an investigation, warrants a revision of the commonly accepted, modern, professional dictum that it is not contagious. Very strong data exist to prove that the disease has been communicated there, at least, by contact, and such is the firm belief of all physicians who have observed it in those islands. It might well be inoculated by means of vaccination, or in connection with venereal lesions, from leprous subjects. It may first show itself in early childhood, or at any subsequent age.

PROGNOSIS.—The disease is almost uniformly fatal, although its course may be influenced, favorably or unfavorably, by the circumstances and residence of the patient. Removal, in the early stages of the disease, to regions where it is not endemic, may delay its progress. In this connection it may be mentioned that Dr. Gronvold, of the Norwegian Colony in Minnesota, has furnished to the American Dermatological Association interesting data regarding the disease as it exists among his countrymen, showing an equal representation of the tubercular and anæsthetic forms; its steady progress in those patients who exhibited the first symptoms of the malady in the old world; and no

instance in which the disease has been transmitted to children born in America. He believes that the disease in his patients would have advanced more rapidly in the old world. In a very few, the disease seems to have remained without increasing in severity, but in the larger number it has been in no way retarded. The tubercular form of leprosy proves fatal, on an average, in nine years; the anæsthetic form in eighteen years; cases may continue for twenty-four years.

TREATMENT.—There is no specific remedy for the cure of leprosy. New drugs have been from time to time introduced into its therapy, their fleeting reputation having been based upon their temporary, tonic action; among the most recent of these are Gurjun balsam and Chaulmoogra oil. The patient should be removed if possible from leprous regions, and the individual symptoms met at once, as far as practicable, with proper remedies. The strength is to be sustained with nourishing food, good air, and tonics. The cutaneous manifestations may be influenced somewhat by treatment. The tubercles and infiltrations may be painted with iodine preparations, or covered with mercurial plaster, by which their absorption is promoted. Ulcers are to be handled according to general surgical rules. Anæsthesia may be relieved to some extent by electricity. The dangerous intercurrent affections, and the final marasmus, of course demand their own appropriate treatment.

PERFORATING ULCER OF THE FOOT.

(Synonym: *Mal perforant du pied.*)

The individuality of this peculiar affection was first pointed out by Nélaton, in 1852, but its true nature has been recognized only within a few years. It is not strictly an *ulcer;* it is an *opening* upon the surface of the foot, communicating by a sinus with the interior disease, which opening may be surrounded by granulations, may be seated in the centre of a corn, or may be established in portions of the integument only slightly inflamed; it may, however, be surrounded by extensive ulceration of the cutaneous tissues. The situation of the orifice is, most commonly, over the articulation of the metatarsal bone with the phalanx of the great or little toe. It may, however, be on other parts of the foot, or upon several parts at the same time. Both feet may be affected by the disease, and in rare instances it occurs upon the hand. There is generally but a slight discharge of a sanious fluid, from the opening, and, if this be probed, the instrument passes directly through a narrow sinus to diseased bone. There is no pain in the part, but, on the contrary, a marked insensibility of the opening or ulcer, an anæsthesia which extends to the surrounding portions of skin in an irregular way. The toes especially are insensible. The temperature of these parts is generally reduced, and their surface is often covered with perspiration; otherwise, the skin in the early stages of the disease presents no abnormal appearance, and motion of the limb is not interfered with. At a later period, for the disease progresses very slowly, the tendons become affected by the internal changes, causing distortion of the toes. The nails are yellow and fissured, and assume a lateral curvature. Thick collections of epidermis form upon the soles and dorsum of the foot, and the cutaneous pigment undergoes hypertrophy. The hairs, too, of the part take on undue growth. An examination of the foot shows extensive changes of the internal structures, sinuses running from the ulcers or orifices to carious bones, with inflamed bursæ, open joints, and the disappearance of cartilages.

The nature of this disease, which affects men especially, but sometimes

children, has recently been satisfactorily explained by a study of the nerve tissues of the affected parts. The endoneurium of the nerves leading to the seat of disease has in all cases been found to be thickened, while their sensory and nutrient fibrils have been found wanting or degenerated. The larger or motor fibrils are unaffected. In consequence of these changes, the nutrition of the parts is destroyed, and the tissues supplied by them undergo degeneration. The disease may, therefore, begin within, as well as upon the surface. Similar ulceration of these structures has in fact been observed in consequence of diseases of the nerve-tissues, in anæsthetic leprosy, locomotor ataxia, and progressive muscular atrophy, and in cases of compression of nerve trunks and of the spinal cord. Injuries of the peripheral nerves may in this way account for the occurrence of perforating ulcer after contusions of the feet, as has often been observed. We must regard the affection, therefore, as primarily one of the nervous tissues, either of central or of peripheral origin, and all other changes of structure as secondary to, and dependent upon, disturbed nerve action. This explains the frequent and persistent recurrence of the disease in its cutaneous manifestations, after these have been healed by prolonged rest of the parts, and its repeated return after excision of all the apparently diseased structures. The prognosis is therefore doubtful, as there can be no certainty of a permanent cure.

TREATMENT.—By prolonged rest of the limb in a horizontal position, the ulcer or orifice in the integument may often be made to heal, in the early stage of the affection, only to establish itself again, however, in most cases, when the part is used. Excision of the soft parts, or amputation of the toes, or of even more extensive portions of the foot, has often been followed by equal want of success. It is apparent that, to be radical, such an operation should include also the whole of the diseased nerve tissue, that is all the parts which are anæsthetic. As a palliative method, it has been suggested that the patient should wear an artificial leg attached to the bent knee, so as to constantly relieve the foot from all pressure or jar.

CARCINOMA.

Under this general term may be included all forms of cancer of the skin; that is, new growths of the cutaneous tissues which have a malignant course, and which are characterized by collections of proliferating epithelial cells, arranged in alveolar form, or in tubular, bulbous, or dendritic shapes, within meshes of fibrous tissue. These forms are *epithelioma, connective-tissue cancer*, and *melanotic cancer*.

EPITHELIOMA. (Synonyms: *Cancroid ; Epithelial cancer ; Rodent ulcer*.)— Epithelioma presents three quite distinct clinical varieties: the flat or superficial form; the deep-seated or nodular form; and the papillomatous form.

Superficial Epithelioma.—This form of the disease is better known as *Rodent ulcer*. It begins as a minute, firm, yellowish or red prominence, or as a group of such prominences arranged in a line or cluster, which may exist in this inconspicuous form for a considerable period. Sooner or later, the growth becomes slightly scaly on its summit, and subsequently softens at its tip, and is excoriated, giving escape to a little fluid, which dries upon it into a yellowish or brownish crust. The scale is frequently removed intentionally, or by accident, only to form again, becoming thicker each time, while the nodules very gradually increase in size. It may continue in this condition for years, scarcely

attracting the attention of the patient, who regards it as an innocent pimple, or, perhaps correctly, as a wart or mole which has existed beyond the period of his recollection, as this form of the disease very often has its seat and starting-point in such pre-existing, harmless growths. After a time, however —it may be five, ten, or more years—the disease assumes a more active course. New nodules, resembling the original formation, appear at its edge: minute globular elevations, containing a soft material resembling milia, which may be squeezed out, and are found to consist of masses of epithelial cells. These in turn desquamate, become excoriated, and add to the size of the original crusted lesion. Thus, in time, a circular prominent patch, of a dull-red color and covered with scales and crusts, is formed, varying in size from that of a pea to that of a dime, when eventually the whole central portion softens and is cast off, leaving a shallow, ulcerated surface. Its shape is generally irregularly circular, and it is separated from the surrounding skin by a slightly elevated, hard border, which often overlies a deep infiltration. The surface of the ulcer is generally flat, and of a dull-red color, secreting a thin, viscid fluid, which dries into a firm crust.

In this way the rodent ulcer is established. Its growth may continue by the same process of development of fresh nodules at its periphery, until it becomes one or more inches in diameter, characterized, however, to whatever size it attains, by the elevated, sharply-defined, infiltrated border. At any time the ulcer may show a disposition to spontaneous involution, the epithelial new-growth being cast off by suppuration, or otherwise perishing at its base, and a thin, depressed cicatrix forming in its place. The scar formation may be only partial, however, the ulcer healing in the centre while it progresses peripherally, or undergoing a complete cure throughout its extent, with the exception of some portion of its border, which still remains indurated. Until this infiltrated edge is wholly resolved, the activity of the disease at such parts is to be counted upon. Even when the cicatrization seems to be universally complete, it may revive at any point of its periphery. In this way the disease may go on in alternate stages of progress, partial cicatrization, quiescence, and renewed activity for many years, until considerable portions of the skin have been run over in its spread from the original centre, the patient remaining in good health, and the nearest glands being unaffected. At times, more or less pigment is deposited in the border, or scar tissue, especially when the disease affects the scrotum (*soot cancer*). Except for the disfigurement which it causes, the prognosis of rodent ulcer may be regarded as not unfavorable, unless it should become the seat of the deep form of epithelioma, into which it may at any stage be transformed.

Deep-Seated Epithelioma.—This, the nodular form, may, as above stated, be developed from the flat variety, or rodent ulcer, at any period of its existence, or may start primarily in the normal skin. It begins as a firm nodule, as large as a shot or pea, single or multiple, which is felt from the start to include the whole extent of the cutis, and to penetrate at times the subcutaneous tissues. Its growth is generally very slow, attaining after months, it may be years, the size of a filbert, or perhaps exceeding it, and forming a firm, shining, reddish tumor of a flattened or globular shape, which is at first movable with the skin, but subsequently becomes adherent to the underlying tissues. It may spread peripherally, and affect a considerable portion of the skin, showing itself superficially by an uneven surface, or nodular elevations, or by central depressions produced by the shrinking of the older diseased tissue, and peripherally by a smooth, notched, or abruptly elevated border. Occasionally, the small cancroid nodules above described show themselves at the edge of the growth. After a time, it may be months, but in other cases

several years, the growth undergoes ulceration, superficial or deep seated, according to the depth to which the cancerous infiltration has penetrated. In the former variety, we have an ulcer similar for a time to that of flat epithelioma; in the latter, one extending by gradual penetration, or by rapid disintegration of the upper layers of the skin, to deeper parts. It presents a finely granular, reddish surface, which secretes an ichorous fluid, forming, it may be, a thin glaze over it, and has an abrupt, hard, irregular edge. The ulceration follows closely upon the spread of the infiltration peripherally, so that it constantly increases in extent and depth. It does not confine its ravages to the cutaneous tissues, but penetrates to all underlying structures, muscle, cartilage, and bone. Occasionally a portion of the growth may slough away, and leave healthy granulating tissue, which tends to cicatrization, but such attempts at spontaneous cure are partial, and do not affect the final result. Sometimes, too, the growth assumes the appearance of medullary cancer in late stages. The glands eventually become implicated, sharp pains in the part reduce the strength of the patient, marasmus gradually develops, and, after years of such progress, a fatal result ensues.

Papillomatous Epithelioma.—Sometimes epithelioma begins in the form of an elevated growth—having at times a constricted neck, at others a broad base—varying in size from that of a dime to a diameter of several inches. Its surface is flat, or umbilicated, smooth, or covered with yellowish, closely adherent scales. In its advanced stages, its surface is ulcerated and granulated, or fissured, red, bleeding easily, and discharging an ichorous fluid which covers the growth on drying with brownish crusts. The same comedo-like, nodular masses may sometimes be squeezed out from it as from the two preceding varieties. It may develop in the course of the flat epithelioma, in which case its seat is superficial; or from the nodular form, when it may be felt extending deeply into the cutaneous tissues. It may originate in its own form, but more commonly grows from surfaces already affected by one of the other varieties, and runs a more or less rapid and malignant course according to the particular form with which it is associated.

Locality of Epithelioma.—The most common seat of epithelioma is on the face or genitals. It seldom occurs primarily elsewhere. Upon the *face*, flat epithelioma most frequently affects the region of the nose, eyelids, and cheeks, from which it may spread extensively to neighboring parts of the integument. It is in these regions that warts and senile forms of keratosis are so apt, in late life, to become the starting-point of the disease. Disfigurement, even in the course of the superficial form, is often produced by shrinking and cicatrization in the regions of the nose and eyelids, but when the disease assumes the nodular form, the destruction and disfigurement are often frightful. The eyelids may be wholly destroyed, the soft parts of the nose eaten away, or the ear entirely consumed. From these openings, the disease penetrates to the mucous membrane and soft parts of the adjoining cavities, finally attacking the bones. The teeth are lost, the antrum and frontal sinuses are opened, and the surface of the cranium may be exposed and destroyed by necrosis, so that the membranes of the brain become visible. The fungoid or papillomatous form may develop in such advanced stages of the disease. Upon the lip, epithelioma begins almost always in the nodular form, and may spread to the mucous membrane of the mouth. At times, all three varieties of the affection may be exhibited simultaneously upon the face, in these various regions. Upon the integument of the *genitals*, the disease may begin in the flat form, which, with little delay, becomes deeply infiltrated, and runs a comparatively rapid, fatal course; or it may slowly spread without infiltra-

tion upwards over the pubic region, or down upon the inner thighs in a serpiginous course. Upon the *trunk*, epithelial cancer very rarely occurs primarily; upon the *extremities* still less often, unless it be developed upon preceding lupus growths, or ulcers from other forms of disease.

Anatomy of Epithelioma.—According to Kaposi, who has given an admirable account[1] of the new growths of the skin, a section of its structure in the *superficial* form of epithelioma, shows that the prolongations of the rete downwards into the corium are greatly elongated in the form of slender conical cylinders, which broaden as the disease progresses, and nearly obliterate the intervening papillæ, or even send out lateral processes, which anastomose with similar processes, or which terminate in free bulbs. In the *nodular* or *deep-seated* form, these epithelial, cylindrical new growths penetrate more deeply into the fibrous structure of the corium, interlacing in all directions, and, in addition to them, globular masses, having an alveolar or concentric arrangement, are found, consisting of small cells in their central portions, and of large flattened cells in their external layers. These peculiar bodies are called *globes épidermiques, epithelioid pearls, epithelial globes, inflammation cells,* etc. They occur in the midst of the epithelial cylinders, of various sizes, but they are not peculiar to epithelioma. The *connective tissue* is not materially altered in the flat form of the disease, but in the deep seated variety is not only encroached upon, throughout, by the new growth of the epithelial bodies, but these are surrounded by round cells, and, in the papillomatous form, traversed by new bloodvessels. The *glandular structures* of the skin are but slightly altered and enlarged, or undergo fatty or colloid degeneration. In the progress of the disease, the encroaching cylinders destroy the corium and underlying tissues by atrophy or by interrupting their nutrition. The new growth itself may undergo fatty or colloid degeneration, become absorbed, or break down in ulceration. The epithelial new growth has its origin, according to Virchow, in the connective tissue; according to Thiersch, only from the pre-existing epithelium of the rete or glands; according to Koester, from the lymph cells; according to Biesiadecki and Warren, from the small wandering cells or leucocytes. Kaposi's own views are that the first cancroid cylinders are the epithelial cones of the rete, proliferating freely; that the epithelial lining of the sweat-glands may also serve as the starting-point of the proliferation; and that it is probable that the connective tissue involved may be stimulated to epithelioid as well as to inflammatory proliferation.

Etiology.—Epithelial cancer, although much more common after middle life, is not impossible in childhood. It occurs more frequently in men than in women. There is no evidence of a tendency to its being inherited. Excepting the action of local conditions, we have little knowledge of its causes. Any chronic alteration in the epithelial structures of the skin may conduce to its development, and accordingly warts, pigmented or sebaceous, collections of epidermal scales, the bases of cutaneous horns, etc., frequently serve as the starting-points of the disease. Senile forms of keratosis, especially, are prone to such transformation into epithelioma, and all such conditions of the cuticle should be looked upon, in old people, as possible seats of the affection, and should receive proper treatment in view of such suspicion (page 618). Again, long standing inflammatory states of the cutaneous tissues may become the seat of such transformation, as is seen in old ulcers of the leg, lupus granulations, etc.

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[1] Pathologie und Therapie der Hautkrankheiten.   Wien, 1881.

Prognosis.—Some of these forms of epithelioma are so little dangerous that they scarcely deserve the title "malignant." The *superficial* variety may continue to progress, or remain stationary, for fifteen or twenty years, and then heal by cicatrization, permanently or temporarily; or may exhibit, for long periods, only a slight activity, at points about the periphery of the scar. On the other hand, its prognosis is much more serious should it develop into the *nodular* form of the disease. This variety, although capable of protracted quiescence or very slow progress, has always an unfavorable future if left untreated, producing not only deep destruction of tissue, but often loss of life itself. The *papillomatous* or *fungoid* form is still more dangerous. All forms, if treated in good time, are susceptible of complete cure. Epithelioma may recur, after extirpation, but only locally; and in its advanced stages, its progress may generally be stayed, or its fatal end delayed for a long time.

Treatment.—Internal remedies, in epithelioma, are of service in those stages only in which the strength of the patient has begun to fail. There are none which have a specific action upon its course. Extirpation of the cancerous growth is the only resource. This may be effected by cauterization or by excision, and the choice between these methods must be determined in each case by the extent and position of the disease. One is as effectual as the other, where both can be thoroughly applied, and recurrence is, in such cases, equally common after both.

In the *superficial* forms of the disease, caustics are decidedly the best remedy, because their destructive action penetrates to sufficient depth to exterminate the new growth, and produces only a thin scar without subsequent contraction of the surrounding integument—a most important consideration in the vicinity of the eye and nose. When the disease occupies a large area, too, cauterization is the only practicable operation. The special agents to be employed are those which have been recommended in the treatment of lupus, as the same object is to be accomplished in both affections, viz., the destruction of new cell growth. In the flat form, where the infiltration is superficial, this may be effected by the use of the milder caustics, such as pyrogallic acid. This, mixed with lard in the proportion of one or two to eight, and spread thickly upon cotton cloth cut to fit the area to be attacked, is to be applied for three days and nights continuously, fresh plasters being substituted each morning and evening. This process is to be repeated two or three times, if necessary, as soon as the crust which follows the action of the caustic falls off; that is, until healthy cicatrization is established. Should this result fail, we may, as in lupus, resort to the arsenical paste (page 645), spread thickly upon strips of cloth, and applied for three days, the paste being renewed every twenty-four hours. The pain and œdema, especially about the eyes, which come on during the third day in both methods, rapidly subside when the caustics are removed. Under the action of both methods, only the diseased growth is destroyed, the healthy tissues remaining unaffected by the caustic. Single points of growth may be destroyed by thorough boring with the crayon of nitrate of silver, used repeatedly at intervals of a few days. In the *nodular* form of epithelioma, we may use the stick of nitrate of silver, gouging out with it the soft growth, or we may employ the curette, applying the cautery after scraping. Concentrated nitric acid, too, may be used, boring into the growth with a pointed stick of wood dipped in the acid. If the nodules extend very deeply, we may destroy them with Vienna or chloride of zinc paste. The same applications may be employed for the *papillomatous* growth, but they should never be used when it is important to save as much tissue as possible, for they respect neither sound nor diseased structures.

Where the growth is deep, and occupies a small area, excision may be resorted to, as affording a linear scar only, and as being a shorter process than the slow repair which necessarily follows deep cauterization. A plastic operation may often prevent or correct marked disfigurement upon the face. Every case should be closely watched after any form of operation, and every nodule should be destroyed with caustic at once, as it appears about the edge of the wound or cicatrix, or, if deep infiltration recur, the whole mass should be extirpated again without delay. In this way, by constant watchfulness and attack, nearly every case may be restored to and kept in a healthy condition, if treatment be begun before the disease has become very extensive. In even the most advanced stages, its progress can be delayed, and the general condition of the patient improved by such local treatment alone.

CONNECTIVE-TISSUE CANCER.—Other forms of cancer affect the integument, either primarily or by extension from underlying parts. One, the so-called *lenticular* variety, is developed in the skin above a mammary cancer, or after its excision, in the form of nodules, which vary in size from that of a pin's head to that of a bean, and are firm and glistening, and sometimes reddish-brown in color. Subsequently the nodules may soften at their summits, and become excoriated, and may unite to form irregular, tubercular masses. In this way, large districts of skin upon the chest may be converted into a tissue of cuirass-like hardness, which may extend down upon the lower trunk or the arms. The glands in the axillæ become enlarged, and a fatal termination is not long delayed. In another form, *Carcinoma tuberosum*, the disease appears, in old persons, as larger nodular swellings, the size at times of a walnut, or hen's egg, occurring upon the face and hands. The swellings may occur in large numbers over the general surface, and are generally associated with similar masses in the internal organs. The surface of the tumors is often of a dark-red color, is easily denuded, when it becomes covered with a greenish crust, or may be destroyed by deep ulceration. In some situations, the surface may assume a warty, fissured condition, especially upon the back of the foot. Single nodules may be completely cured by ulceration. After a few years, the disease generally ends fatally.

MELANOTIC CANCER.—The third variety is *melanotic* or *pigmented cancer*. This begins in the form of one or several, smooth, round nodules, of a slate or black color, of the size of a small shot or pea. They are situated most commonly, at first, upon the hands and fingers, feet and toes, but may begin upon any part. They enlarge, or, by confluence, form an irregular, tubercular, fungoid growth. After a time, the mass softens, and is converted into an ulcer, which penetrates deeply into the underlying tissues. Subsequently, other nodules appear, either about the primary seat or scattered along the course of the large lymphatic vessels, until the legs and abdomen become quite thickly occupied by the small blackish nodules. After death, to which termination the disease generally hastens at a rapid rate, the internal organs are often found abundantly infiltrated with similar melanotic masses. The nodules consist of a coarse, vascular network of stroma, having in places an alveolar arrrangement, and containing small and large epithelial and spindle-shaped cells, in the form of nests or irregular collections, and diffused and granular pigment.

For these forms of connective tissue and melanotic cancer, little can be done; and excision of individual, even of the primary, nodules, does not prevent their recurrence, nor check the fatal progress of the disease. The tendency to diarrhœa and marasmus, which marks the later stages of the affection, is to be, as far as possible, anticipated by tonic treatment.

SARCOMA.

A multiple form of this disease shows itself, as described by Kaposi, upon the hands and feet—generally upon the latter first—as firm, round nodules, of a brownish or purplish color, varying in size from that of a small shot to that of a bean. These nodules present themselves in a discreet arrangement, or grouped, and are accompanied by thickening of the integument of the feet and hands, which are painful and impeded in movement. After some months, the oldest nodules become scaly and shrink away, leaving a pigmented depression. The confluent patches likewise undergo atrophy in their central portions, leaving the periphery elevated in the form of a firm, hard, pigmented, scaly wall. They never ulcerate. At a later period, the nodules spread to the arms and legs, and, in the course of two or three years, develop upon the face and trunk, of larger size and darker color. Sometimes they soften superficially, exposing a bloody surface. With the more general diffusion of the disease, fever, diarrhœa, and marasmus occur, and it proves fatal in from three to five years. After death, similar reddish, nodular masses may be found in abundance in the lungs, spleen, heart, and intestinal canal. The nodules consist of small round cells arranged in groups, hemorrhagic deposits, and pigment. In other cases large-celled growths have been observed.

In another form of sarcoma, these cutaneous phenomena are greatly exaggerated. Infiltrated, red patches appear suddenly upon any part of the body, and may afterwards disappear, leaving brown stains, or may increase in size so as to cover considerable areas of skin. Their surface may cast its epidermis, and allow a serous or bloody discharge to escape. On other parts, fungoid tumors may arise, of a red or violet color, varying in size from that of a bullet to that of a hen's egg, sometimes smooth of surface, sometimes fissured. These growths may also disappear spontaneously, or may undergo ulceration. They may occur in great numbers and upon any part of the surface. They, too, consist of masses of small round cells infiltrating the fibrous tissue of the corium and underlying structures. This form of disease has received various names from its respective observers, such as *Mycosis fongoide ; Inflammatory fungoid neoplasm ; Fungoid papillomatous tumor*, etc. It ends fatally, generally within two or three years.

MADURA FOOT.

(Synonyms: *Mycetoma ; Podelkoma ; Fungus foot of India.*)

This is a destructive disease of the feet, and occasionally of the hands, which is prevalent in certain parts of India. The foot becomes greatly swollen and deformed, and presents numerous tubercular elevations, with fistulous openings from which a peculiar matter is discharged. The affection begins sometimes with the appearance of pimples or sores about the toes, sometimes with congestion and thickening of the integument ; we have, however, no very definite account of its earliest manifestations. When first seen, the part generally presents small tubercular elevations, which discharge a thin fluid from fistulous openings. These tubercles gradually multiply ; the foot undergoes thickening, losing all shape ; the toes are distorted, or blend with the common mass ; and the calf dwindles. The progress of the disease is very slow, lasting from five to twelve years. It is accompanied by severe pains in the part. The skin has generally a peculiar whitish appearance about the mouth

of the sinuses, and from them are at times discharged peculiar black and white masses. The same kind of black granular matter sometimes studs the surface of the tubercles, and has, in its gross appearance, been likened to fish-roe. On section of the foot after death, or after amputation, all its soft tissues are found to be converted into a homogeneous, opaque, gelatiniform substance, traversed in all directions by canals, which communicate with large and small spherical cavities, varying in size from that of a pin's head to that of a bullet. The bones of the foot, as well as the lower ends of the tibia and fibula, are perforated in every direction by similar cavities, which, like those in the soft tissues, are filled with a soft material, usually yellowish, but sometimes pinkish, and sometimes black. It is with regard to the nature of this material which fills the cavities and canals, and which is from them discharged upon the surface, that the greatest difference of opinion prevails among those who have had opportunities of studying the disease. Dr. Carter, of Bombay, first gave prominence to the opinion that the disease was due to the presence of a vegetable parasite, and described the peculiar substance found in the diseased tissues, of the various colors above mentioned, as masses of fungus growth, a *mucor* or *chionyphe*. Berkely, a leading mycologist, has pronounced a similar opinion as to their nature. Other observers deny that the disease is either in origin, or essentially, a mycosis, regarding it as of internal origin, and considering the occasional presence of possible fungus-growth as only accidental. Whether the disease be primarily deep-seated, establishing its connection with the outer surface and integument in its later stages; or whether it begins at the periphery, has never been definitely established, for want of proper study of its early stages. Its parasitic nature must still be held in doubt. Pathologists who deny this, have no explanation to give of the peculiar characters of its anatomical changes. The disease attacks men most frequently, and makes its appearance generally after adult life. Its tendencies are to a fatal termination after a long course. The only treatment found effective is amputation above the line of disease. A case closely resembling mycetoma has been described in this country by Dr. Kemper.[1]

Parasitic Affections.

I. *Vegetable Parasites.*

There are three well-recognized diseases of the skin caused by the growth within its tissues of vegetable parasites. These are *Tinea favosa*, *Tinea trichophytina*, and *Tinea versicolor*. The growths which cause these affections belong to the lowest order of plant life, the fungi or moulds, and consist, as far as represented in such a phase of existence, of fine, cylindrical, thread-like, elongated filaments called *mycelium;* of minute, spherical, or ovoid cells called *spores*, or *conidia;* and of even more minute bodies, *micrococcus*, or *stroma*. These forms are capable of reproducing themselves, when transferred under proper conditions to the skins of other individuals. From what source they originally became parasitic upon man, or what their real botanical relations are to common moulds, we have no positive knowledge.

Tinea Favosa.—Favus, as it is commonly called, is the least frequent of these affections. It is characterized by the occurrence of yellow crusts upon the scalp or general surface, circular or ovoid in outline, and concave above. These vary in size from a minute point to half an inch in diameter, and are several lines in elevation above the surface of the skin at their edges. By

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[1] American Practitioner, September, 1876.

confluence, however, the crusts may form larger patches of irregular shape, the peculiarity of this being caused by the seat of the patches and their method of growth. The minute elements of the fungus gain entrance to the tissues of the skin through the opening of the hair follicle, and from this as a central point extend downwards into the hair canal, and outwards in all directions into the epidermal layers. At first, a minute globular mass is formed, but, as the growth increases, it is held down at its centre, where it encircles the hair, while in the free epidermal tissues it is allowed an upward as well as a peripheral growth. Upon the scalp, where the hairs are most fully developed, the concave shape of the crust is longest retained, whereas, upon the general surface they lose this characteristic form when large, and project to a much greater elevation. If we remove one of the small and perfect crusts, which is easily done by any blunt instrument, we shall find its under surface convex, and that it is seated upon a smooth and shining, depressed surface of epithelial cells, upon which another crust is immediately reproduced. The color of the crusts in their central portion, or when small, is bright orange; fading when large, at the outer and older portions, to a pale lemon tint. Their odor is disagreeable and mouse-like, and they are of soft consistence. These appearances may be modified by rough handling on the part of the patient, or by the admixture of the fluid products of inflammation, pus, serum, or blood.

There is a stage, however, in favus, preceding the appearance of the crusts, which is generally overlooked upon the scalp on account of the presence of the hairs, and which is no doubt often mistaken for ringworm. It is best studied by observing the effects of inoculation upon other portions of the surface. This is most successfully accomplished by enlarging the openings of hair follicles with a needle, and by applying to the punctures some of the fungus rubbed up with water. In a few days, a red spot is noticed, which is somewhat scaly upon the surface, and which increases slowly in size, apparently returning to a natural condition in the centre as it spreads outwards, and with a slightly elevated border. Sometimes minute papules or vesicles may be seen within the patch. These appearances, so strongly resembling ringworm (Tinea trichophytina, in its circinate form), may last three or four weeks, and then, if the growth should not chance to establish itself within the hair follicles, may disappear without the production of a true favus cup or crust, though often minute masses of the characteristic yellow color may be seen. The error of mistaking this, sometimes called the ringworm stage of favus, for true Tinea trichophytina, and an occasional chance coincidence of the two diseases upon the same portion of skin, have given rise to the opinion, on the part of some dermatologists, that the fungus is identical in both affections.

The clinical proofs of the non-identity of the two diseases are found in the fact that pure ringworm occurs in thousands of cases without any development of favus; in the highly exceptional simultaneous or consecutive appearance of true ringworm in cases of favus; in the frequency of the former in communities, and the rarity of the latter, and in the varying relations of their comparative frequency both in different countries and in cities and rural districts; in the prevalence of ringworm of the scalp in orphan asylums for years continuously, without the production or transmission among the inmates of any parasitic affection other than itself; in the ease with which the one, and the difficulty with which the other, is communicated; and in the spontaneous transmissibility of both forms from man to the domestic animals, and back again through several hosts to the human subject—their individual identity being without exception preserved meanwhile. These, and other facts which might be mentioned, would seem to be conclusive in this matter.

The results of inoculation and of artificial cultivation, too, support the view of the specific individuality of these affections.

Upon the general surface, favus causes at times a slight degree of irritation, occasionally sufficient to excite an eczematous inflammation in the underlying and surrounding skin; but generally its presence is productive of little inconvenience. Upon the scalp, however, its effects are of a more serious nature. The hairs soon begin to change color, becoming gray or white, lustreless, stiff, and brittle, and after a while break off at the surface, or are discharged by suppuration with the surrounding favus masses. The disease spreads in time over the whole scalp, the loss of hair beginning generally at the front and lateral portions. The baldness may be only temporary, but in chronic cases the papillæ and follicular structures may be entirely destroyed by atrophy or by inflammation produced by the presence within them of the fungus growth. In this way is caused the firm, white, and glazed condition of the scalp, so characteristic of old cases of favus. In some instances, atrophy of the bones of the skull, even, has been observed. It can be easily understood that, by combing and scratching, or by rupture of the crusts in other ways, and by the use of bandages and caps worn to conceal the presence of the disease, favus matter may be transplanted from one part of the scalp to another.

Upon the constitution and health generally, favus has little or no effect. It is often seen upon sickly looking children, but such coincidence indicates merely a neglect most favorable to the progress of both the local and the general affection. It may possibly thrive more vigorously upon the devitalized epidermal tissues of a person debilitated by disease, but it occurs also upon those in robust health. Favus affects the nails, too, occasionally; generally in persons who either carry the growth in some other part, or have charge of those affected by it. The substance of the nails becomes yellow, opaque, and greatly thickened, and their surface becomes rough. A well-defined favus crust may sometimes form beneath them.

If we examine, with the microscope, the matter of which a favus crust is composed, upon whatever part of the body it may be growing, we shall find, in addition to modified epithelial cells: (1) innumerable minute cells of an irregularly ovoid shape, attached to each other in groups or rows, and about $\frac{1}{3000}$ of an inch in diameter; (2) others more or less swollen, elongated, divided, or branched; (3) long and very slender tubes, extending from the masses of cells, and more or less subdivided by partition walls, and branched; and (4) matter so small as to appear without definite form when examined by a very high power. The first two forms are the spores or conidia, the third is the mycelium, and the last micrococcus. The spores predominate in the centre of the crust, while the mycelium is found more largely at its periphery, extending into the surrounding epidermis, which holds it encapsuled. If we remove the hair which pierces the centre of the crust, with its sheaths attached, we shall find the walls of the latter distended with innumerable spores, and with the mycelium shooting out into the surrounding tissues. If the hair has been sufficiently long affected to present to the eye the appearances above described, it will be found when examined with the microscope, after maceration in a solution of potassa, to be permeated by canals running lengthwise between its fibres, and by beaded tubes extending longitudinally throughout its substance. Rows of conidia may also be seen encircling the shaft of the hair.

Favus is a rare disease in comparison with the other parasitic affections of vegetable origin. It is mostly met with upon the heads of poor children, for its elements seldom succeed in establishing themselves upon surfaces frequently washed or brushed. Although positively contagious, it is far less so than Tinea trichophytina, and never runs through schools and asylums like

the latter affection. It is frequently observed upon several members of the same family. It affects children more frequently than adults, and is rather more common in the country than in cities. It is found likewise upon domestic animals, especially upon mice, the crusts growing at times to such a size as almost to conceal the head. Cats which catch mice thus affected, exhibit well-marked crusts upon their paws, and sometimes communicate the disease to their kittens. Dogs, too, that have caught mice similarly diseased have had favus developed upon their forepaws. Numerous instances have been recorded in which the affection has been communicated from these animals to children playing with them. The disease has been observed also upon hens, and has been cultivated successfully upon rabbits. The presence of favus upon all these animals can be easily recognized, so that danger of transmission from such sources may be guarded against.

The course of the disease is always slow. Left to itself, upon the scalp, it may last a lifetime, or until it has entirely destroyed the hair. Upon other portions of the body, its duration is not so long, owing to the smaller size of the hair follicles.

Treatment of Favus.—In all the parasitic affections of vegetable origin, it is necessary to apply to the parts affected, such substances as will destroy the fungus growths without producing excessive action upon the animal tissues themselves. This difficulty greatly protracts the cure of these diseases. The number of parasiticides is by no means small—the most effective being preparations of sulphur and of mercury, tar, creasote, carbolic acid, and chrysophanic acid. They may often be combined with advantage. Upon the general surface, the crusts are first to be removed by softening them with fats or poultices, and then by thorough washing with soft soap and water. When the skin is exposed, it may be smeared with the following ointment, once or twice a day, as the skin bears it with or without much irritation: R. Unguenti hydrargyri nitratis, ʒij; sulphuris, ʒij; creasoti, gtt. xv; adipis, ʒss. M. As this ointment stains the surface, it should not be used upon exposed parts. Carbolized olive oil may be rubbed into the affected parts, or they may be painted with tincture of iodine, to which creasote has been added. Chrysophanic acid ointment (ʒj to ʒj) may be used, but with caution at first, on account of its irritating effects, and never upon exposed parts, because of its staining properties. A strong solution of sulphurous acid may be sopped into the affected skin, as freely and as often as the latter will bear it. Several of these methods of treatment may be advantageously employed at the same time, or alternately; for instance, the ointments may be applied at night and some of the washes in the morning, using them all as freely and in as concentrated forms as the skin will bear without becoming inflamed. Mercurial preparations cannot of course be used over extensive surfaces, nor for long periods, without danger. Treatment is to be kept up in all cases for a long time, it being a safe rule to consider the patient to be only half cured, when according to external appearances the disease has wholly disappeared, the plant retaining its vitality in the lower layers of the epidermis after its superficial growth has been destroyed. This rule holds true of all this class of parasitic affections.

Upon the scalp, additional means are necessary, because the large hair follicles are filled with the fungus growth to the base of the skin, and the presence of the hair prevents the entrance of the parasiticides to these great storehouses of danger. It is necessary, therefore, to remove the hairs. Epilation may be best performed with broad forceps. The diseased hairs and stumps come out readily, and with little pain. As many as possible should be extracted once or twice a day, after the removal of the crusts, the process being

extended a little beyond the affected patches, so as to include all possibly diseased hairs. After each sitting, the parts should be washed with strong soap and water, and should then receive some of the above mentioned applications. An ointment should be used for at least part of the day, as its action is more sustained and penetrating than that of the washes. The hairs which are removed each day must be burned, and proper precautions should be taken that the towels, soap, brush, and comb of the patient, as well as his head coverings, be not used by other members of the family. The process of epilation is to be repeated, as the hairs are reproduced, until they assume a healthy appearance and no longer contain any fungus elements. The treatment must be continued, generally, for months, to insure the complete eradication of the disease.

Tinea Trichophytina.—This disease presents such different appearances, according to its seat, that its varieties have often been considered distinct affections, and have received separate titles. Ringworm of the scalp, called *Herpes* or *Tinea tonsurans;* ringworm of the general surface, called *Herpes circinatus;* ringworm of the beard, or *Sycosis*, at times called "barber's itch," as well as by other names; *Eczema marginatum*, a peculiar affection of certain parts of the body, so called by Hebra in his original description; and most of the cases of parasitic disease of the nails, called *Onychomykosis*, are all caused by the presence of one and the same fungus. They may be tabulated as follows:—

Tinea trichophytina
- A. *Of general surface* — Tinea circinata, common ringworm. Eczema marginatum.
- B. *Of scalp* — Tinea tonsurans.
- C. *Of bearded face* — Tinea circinata, early ringworm stage. Sycosis parasitica, Tinea sycosis.
- D. *Of nails* — Onychomykosis.

Tinea Circinata.—The circinate form, or ringworm of the general surface, is familar to everybody. It begins as a red spot, which is slightly elevated above the surrounding skin, and which is covered in a few days with minute papules, or with whitish scales. It increases rapidly in size, flattening down in the centre as it expands, so as to form a circular patch, the elevated border of which consists of a ring—an eighth or quarter of an inch, it may be, in width—of the same papules and whitish scales, while the central portion appears scaly and of a dull red color. Thus it goes on increasing in size, forming at times a complete circle of six or more inches in diameter, which then appears simply as a ring, as the redness and scaliness of the inclosed skin disappear after a time. Sometimes the disease starts up afresh, within the district already swept over, and thus rings within rings may be formed. Generally, after reaching any considerable size, the disease dies out at certain portions of the border or rim, for want of proper nourishment or suitable soil, and segments more or less broken are left to advance over the uninvaded regions of the skin. Generally, too, new spots, the result of self-inoculation, appear before the disease has lasted long, and run the same course. The seat of ringworm is most commonly the neck and face, and these are the parts most likely to be the first affected, from their greater exposure; but large surfaces of the body may be successively swept over before the disease is exterminated, or may exhibit simultaneously the characteristic marks of its presence. When about the face and neck, in children, it may extend its march to the scalp, and may thus give rise to one of the other varieties above mentioned; or, in a man, it may run through the beard, and cause there appearances similar to those upon the scalp in children, or may terminate finally

in another form, Sycosis. It may, however, affect the hairy portions of the face or scalp for a considerable time, and yet manifest itself in no other way than by the formation of the characteristic rings, remaining in the circinate stage. In the latter case, the hair follicles have not become deeply implicated, and the appearances and course of the disease, therefore, remain the same as upon the non-hairy portions of the body. Occasionally these varieties may be seen simultaneously upon one person, and their conversion into one another can sometimes be satisfactorily observed. The sensations which accompany them are more or less itching and burning.

Eczema Marginatum.—There is occasionally observed upon the central portions of the trunk, especially about the inner surface of the upper thighs and lower abdomen, an inflammatory condition of the skin, which Prof. Hebra was the first to particularly describe under the name *Eczema marginatum.* It begins as a small round patch of papules and vesicles, which itches excessively and excites scratching; as it spreads, it heals in the centre, sinking down and leaving a dark red, scaly condition of the skin, while the advancing border presents a constant, elevated ridge of papules, vesicles, and other lesions of eczema upon an inflamed base. The scratching and natural moisture of the parts aggravate the severity of the symptoms and tissue-changes, and give a markedly eczematous appearance to the part. The affection differs from ordinary eczema, however, in the central retrogression and the concentration of its activity at the advancing edges. It may extend thus over large and continuous portions of the trunk and limbs, but the appearances never vary from the type of the raised and narrow margin of papules, vesicles, excoriations, and crusts, and the dark red and scaly state of the parts earlier affected. The parasitic nature of this affection, and the identity of the fungus found in it with that of Tinea trichophytina, were demonstrated by Köbner in 1864. How then does it differ from ordinary ringworm of the skin? Only in the more eczematous character of the lesions which constitute the active, outer border, and the greater amount of congestion and pigmentation of the skin within it. This higher degree of inflammation must be due either to peculiarity of seat, or to the special temperament or tendencies of the individual affected. The former is no doubt the chief reason why ringworm of these parts should assume the peculiarities described as belonging to Eczema marginatum, for they are especially liable to eczematous inflammation. There is no doubt, however, that both position and personal tendencies operate in the production of the disease, for we may have ordinary ringworm of the same parts presenting none of the peculiarities of the eczema marginatum form, and, on the other hand, true eczema may affect them indefinitely as such, without becoming accidentally inoculated with the fungus of, and being converted into, ringworm. The affection then is to be regarded either as ringworm of certain parts, exciting an eczematous inflammation in addition to the lesions which it ordinarily produces, or as ordinary eczema, modified by the subsequent development upon it of the parasitic elements of ringworm. This variety of disease is not very common here, but in India is of frequent occurrence, where it is called Burmese ringworm. The subjective symptoms are an exaggeration of those of the ordinary affection.

Tinea Tonsurans.—Upon the scalp, the disease first manifests itself by the falling of the hair in circular patches. Examining the surfaces of these apparently bald spots, it will be seen that the hairs have not generally fallen out, but have broken off just above the scalp, leaving their stumps to project, and giving, with the scaliness of the early stage, now much more apparent, a peculiar roughness which is increased by a marked prominence of the hair

follicles. (In *Alopecia circumscripta*, which resemblies Tinea tonsurans in configuration, the surface of the patches is perfectly smooth, free from scales, and almost wholly devoid of hair stumps.) At the borders of the patches, among the hairs not yet fallen, a rim of slight scaliness may be seen, where the early stage of the affection is in progress. There is seldom any redness or other sign of severe inflammation, in ordinary cases, but occasionally deep-seated inflammation of the hair follicles, with swelling and prominence of the skin, arises. A viscid fluid is discharged from several openings, and the whole elevated patch feels boggy. This condition is called *Kerion*. The course of the disease after it has attained its second stage, parasitic folliculitis, is always chronic; indeed, it may last for years, and extend over large portions of the scalp, which may be almost completely denuded of hair during the activity of the affection. Permanent baldness, however, seldom ensues, whatever the duration of the disease, unless the inflammation is so exceptionally severe in parts as to destroy the hair follicles. Such destruction, the result of small abscesses, is always very limited, and occurs mostly in children of strumous or debilitated habit. The absence of moisture, or crusts, in Tinea tonsurans, serves to distinguish it from eczema and favus, which, with seborrhœa, are the most common diseases of the scalp in youth. To distinguish it from the latter, and from other scaly affections of the part, the circumscribed baldness will be generally sufficient. For reasons not well understood, this form of Tinea trichophytina seldom affects adults, although ringworm of the face in men is not an uncommon affection, thus affording prolonged chances of its transmission to the scalp. With children, however, the disease is not of infrequent occurrence, especially in asylums where the most favorable opportunity for contagion prevails in the common use of brushes, combs, and towels, and where, if once introduced, it may affect a large part of the inmates, and require years for its eradication.

Tinea Sycosis. (Ringworm of the beard.)

First Stage.—It begins as upon non-hairy portions of the skin, in the form of small points, which generally attain the size of a pea, or are even larger, before attracting attention. They spread rapidly in a circular form, flattening down in the centre as the elevated margin of papules enlarges, and being accompanied by a considerable degree of itching and burning. The centres of the patches remain more or less reddened and scaly, but seldom present the white, brawny look, so characteristic of their seat upon the scalp. The sides of the face and neck are the most common starting points of the disease, and from these the rings may spread in every direction, or new ones may be started from the first, by self-inoculation upon other parts. The disease may thus run on for some time, without any apparent change in the hairs, but sooner or later, the period varying greatly in different cases, the hairs begin to fall from the parts affected, thus defining the patches more conspicuously than before. The hairs break off a short distance above the surface, leaving ragged stumps, as in the scalp. The disease may extend from the shaven portions of the face into parts of the beard worn long, or, beginning in the circinate form upon the neck, may spread upwards into the long hair of the face; but it seldom primarily gets a seat in a full beard. It rarely affects men who wear a full beard, or those who shave themselves, because it is almost always contracted at the barber's. No precautions in the way of separate shaving equipments at these places will insure absolute safety against such chances. Razors are rubbed upon a common strop; towels are used upon several persons in succession; and the writer has treated ringworm upon the fingers of barbers. In such ways the minute germs of the disease may be transferred from one affected individual to many who think them-

selves fully protected against the dangers of the barber's shop. After an indefinite period, varying from a few weeks to many months, it may be after the primary or circinate manifestations have apparently disappeared under treatment, the spores in many cases find their way to the depth of the hair follicles, and the second stage is developed.

Second Stage. (Parasitic folliculitis, or Sycosis.)—This is a most obstinate affection. It begins in the form of small nodules about the hairs, in some portion of the skin previously run over by the disease. These nodules slowly enlarge, and may discharge from their tips pus, which dries and forms crusts about the hair. In later stages, the nodules and pustules may be converted into large, prominent tubercles, which, by suppuration, may give rise to thick crusts; or large excoriated surfaces may be established. The tissues of the skin surrounding the diseased follicles may become involved to a great depth, causing extensive induration, swelling, and disfigurement of the parts. The disease may thus progress gradually over the hairy portions of the face, for months and years, producing, if the folliculitis is excessive, permanent destruction of the hair growth. It is not always easy, however, to distinguish Tinea sycosis from the non-parasitic folliculitis, and from eczema of the same parts. Generally, the morphological changes are much more grave in the parasitic form; its clinical history, moreover, will almost always establish the fact of a pre-existent ringworm; and the microscopic examination of the hairs removed from the least inflamed follicles, will discover the presence of the fungus. In eczema of the bearded face, the inflammation is not limited at first to the tissues immediately surrounding the follicles, and the serous oozing, suppuration, and crust formation, are not centred about individual hairs, but affect uniformly the surface involved. The infiltration of the tissues, too, is more general and diffused, not nodular. These three affections of the bearded face are often confounded under the common title of "barber's itch."

Onychomykosis.—Tinea of the nail remains to be described. Occasionally some one or more of the nails of persons affected with any of the above forms of the disease, or of those having the daily and long-continued care of such patients, lose their transparency, become opaque and dry, and gradually thicken. Their surface appears rough and cracks easily, and their free edge is blunted. Their substance becomes brittle, and flakes off superficially in the form of scales. Such cases form one variety of onychomykosis, of which favus of the nails is another.

Microscopic Appearances.—Microscopic examination of the scaly matter scraped from the surface of the skin in any of these forms of disease, shows innumerable round spores or conidia, $\frac{1}{7000}$ of an inch in diameter, arranged in groups or rows, and, sparingly interspersed with them, long and branching tubes of mycelium. In the affected hairs removed from the beard and the scalp, we find the spores between the sheaths in enormous quantities, and the cells of the cortical substance distended and forced apart by the parasitic growth. It will be readily seen why a hair permeated by the fungus should become brittle and break off with a splintered fracture just above or below the surface of the scalp. In the flattened cells of the affected nails, long chains of conidia, more or less branched, spores, and a few slender tubes of mycelium will be seen. The plant which produces this affection has been called *Trichophyton.*

Contagion.—The sources of contagion in all these forms of the disease are various. Of the habitat of the plant, outside of its parasitic life upon animals, we know nothing. It is probable, from its more frequent occurrence

upon man in America, that in its other phase of existence it is also more abundant amongst us than elsewhere. In children, ordinary circinate ring-worm, occurring most commonly upon the hands and arms, face, and neck, is generally taken by playing with other children similarly affected, whereas the form which occurs upon the scalp is often taken by putting on the cap, or using the brush and comb, of another child who is already suffering from the disease. The obstinacy and duration of this latter variety of the affec-tion, offer protracted chances of such communication. Upon adults, in the form of sycosis, the disease is almost always contracted at the barber's shop, by shaving, as above described; rarely at shops where only hair dressing is done. The marginate forms, occurring about the genitals, may possibly be conveyed during sexual intercourse. All forms, however, are intercommuni-cable. The frequent occurrence of the disease upon domestic animals is a common source of contagion. The animals thus affected are the cat, dog, ox, and hare. There is no reason for supposing any peculiar condition of the skin to be necessary for the development of the disease. There is no doubt a dif-ference, according to individual cutaneous temperament and the general state of the economy, in the reaction of the skin under the parasitic irritation, and in the secondary manifestations, but nothing more that I have observed.

Treatment of Tinea Tricophytina.—In the ordinary circinate or ringworm stage, upon non-hairy portions of the body, the growth of the plant is quite superficial, and very simple agents are often sufficient to work an immediate cure, if thoroughly employed. Among these agents are acetic acid, carbolic acid in various forms, iodine, sulphurous acid, preparations of sulphur, tar, etc. The danger in relying upon them is that the disease appears to be well before the growth in the lower layers of the epidermis is destroyed. Treat-ment is therefore stopped, and relapses follow. Such imperfect management of the first stage of ringworm by the physician, is a frequent cause of the more serious forms of the disease. Generally speaking, it is necessary to continue treatment of the simple circinate variety long after all traces of the disease have disappeared. When it affects hairy parts, such as the scalp or beard, the time required for a cure is always much longer, and is certainly a matter of months—sometimes of many months. Inasmuch as the plant after a time extends to the very base of the hair follicles in these parts, that is, to the extreme depths of the skin, it is necessary to make the parasiticides em-ployed penetrate to these depths, else they will not come in contact with the growth nor destroy it. For not only are the spores within the follicles pro-tected from the action of these drugs by the presence of the hairs, but these are themselves filled with the cryptogamic growth. By pulling out the affected hairs, therefore, we not only remove a part of the disease at once, but also open the hair sacs to the entrance of our remedies. Epilation then must be regarded as a necessity, when the disease affects the beard or scalp. Cases may indeed recover without resorting to it, but the cure is, under such circumstances, much more uncertain and protracted. Not only the stumps within the affected district, but the hairs immediately surrounding it, and not yet showing signs of disease, should be removed. They are easily ex-tracted with broad-bladed forceps, and should be burned as soon as pulled. There is of course no danger of permanent baldness from such pulling, and the new growth which follows has to be removed in some cases a second time. As many hairs as possible should be extracted at one sitting without produc-ing too much irritation in any one portion of the diseased patch.

The choice of parasiticides must depend in some degree upon the seat, ex-tent, and surface condition in individual cases. Where the accompanying eczematous inflammation is especially severe, or where the deeper-seated in-

flammation is intense, as in Tinea sycosis, it is sometimes necessary to employ preliminary treatment before the proper antiparasitic remedies can be used. For the ordinary superficial circinate forms, a solution or ointment of the corrosive chloride of mercury (gr. ij to ℥j), if the surface affected be not too extensive, may be applied twice a day as freely as the skin will allow without over-stimulation. Upon the face and other parts exposed to view, these may be used to advantage, because they do not discolor the skin. Iodine, as a tincture, or rubbed up with equal parts of iodide of potassium and glycerin, may be painted upon the affected surface. Sulphurous or carbolic acid in solution, may also be applied with success, though less certain in their action. These should all be used much longer than the appearances seem to require. An ointment of chrysophanic acid or Goa powder (℥ss or ℨj to ℥j) may be used upon parts protected by the clothing. When the disease affects the beard or scalp, and has already invaded the hairs, our remedies must be used for a long time, and in connection with epilation. Some such course as the following may be used : at night, an ointment made up in varying proportions, but substantially as follows—Hydrargyri ammoniati ℨj, creasoti gtt. xv, sulphuris sublimati ℥ss, adipis seu vaselini ℥j—is rubbed thoroughly into, and a little beyond, the affected districts. In the morning, this is washed off with soap—with soft soap if well borne—and epilation is then performed. Immediately afterwards, the officinal solution of sulphurous acid is sopped freely over the parts, which are then left to themselves for the day.

The face will not stand as rough treatment as the scalp, and soothing ointments, such as those of zinc or diachylon, must often be used by day to counteract the over-activity of the nocturnal remedies. Quick cures are impossible ; sure results are to be attained only by the long-continued use of the most active remedies, thoroughly applied. Even by such use, and long after the faith and endurance of patients and attendants have been tired out, relapses will often occur after treatment has been given up, because there has been left undestroyed in the deep recesses of some hair follicle a single spore of the many millions first attacked. No internal remedies have any direct effect upon the destruction of the fungus. The clothing worn next the parts affected should be soaked in boiling water, or destroyed, and the brushes, combs, and other articles, which have come in contact with the diseased skin, should be treated in the same manner.

Tinea Versicolor. (Synonym: *Pityriasis versicolor*.)

This disease is characterized by the presence of yellowish or dark-brown spots of irregular outline, but slightly elevated, and covered with fine scales which are easily scratched up by the nails, or removed by scraping with a knife. They vary in size from minute points to confluent patches covering large portions of the chest or abdomen. They chiefly affect the front of the trunk—beginning generally upon the chest—and may extend downwards so as to cover more or less wholly the abdomen, hips, and upper thighs ; may pass upwards to the shoulders, and thence down to the forearms ; or may creep around the chest to the back. They rarely appear below the knees and elbows, or ascend upwards upon the neck, and they never affect the face. In other words, they do not generally grow upon those parts of the skin which are exposed to the air and light, finding rather upon those parts protected by clothing, the warmth, and possibly the absence of light, essential to the development of the plant, upon the presence of which the disease depends. It seldom, if ever, occurs upon children, which fact may be explained, perhaps, by the choice which the parasite shows for the dry and outer cells of the epidermis, those of adult life being probably better adapted in this respect to its

needs. When once established, it seldom disappears spontaneously, but may go on for years, perhaps dying out largely during the winter, to revive and extend over wider areas during the summer. It often gives rise to great itching of the parts affected, although in some cases the patient is not made conscious of the presence of the disease by any subjective symptoms. It is often mistaken for the pigment stains upon the skin, called *moth* or *chloasma*, an affection which differs from it in position, course, and clinical history. It is of quite frequent occurrence, although its presence is often overlooked by its host, and is discovered by the physician when examining the naked chest for other purposes. It is for this reason only that it is so often found upon consumptive patients, for its growth is entirely independent of the general condition of the person affected, nor does it exert any injurious influence upon the same. It is positively contagious, although by no means so easily communicated to new hosts as ringworm; and its direct transference from one individual to another is seldom observed except among those living in the closest personal intimacy. Upon the domestic animals it has never been observed.

Microscopic Appearances.—If some of the scales removed from a patch of the disease be treated with a drop of potassa solution, and examined with the microscope, countless numbers of round conidia or spores are seen, grouped in clusters, of high refractive power, and resembling minute oil globules. Associated with these are fine tubes of mycelium, running in a network of endless intricacy. The growth extends but slightly within the hair follicles. The plant concerned in the production of this disease has been called *Microsporon furfur*.

Treatment.—As the growth is very superficial, less active parasiticides are required for its destruction than in cases of favus or ringworm. Thorough sopping with sulphurous acid, morning and evening, is a cleanly method of treatment, but is objectionable on account of its suffocating properties when applied over large surfaces. Oil of turpentine, rubbed into the parts at night, will be generally well borne, and is an effective remedy. A sulphur ointment mixed with creasote (Sulphuris ʒss, creasoti gtt. xv, adipis ℥ij) may be rubbed in every night, as thoroughly as the individual's skin will allow, and is then to be washed off in the morning with tar soap, or, if the skin will bear it, with soft soap. Mercurial preparations cannot be employed when the affected surface is extensive. Whatever remedies are used, are to be applied continuously for long periods, even after the disease has apparently disappeared. Unless this precaution be followed, the growth will surely revive after a longer or shorter period.

II. *Animal Parasites.*

The animals that are strictly parasitic upon man, those, that is, that attach themselves to him throughout all the phases of their existence, and derive their sustenance from his tissues, are few in number. They are: Demodex folliculorum, Sarcoptes hominis, Pediculus capitis, Pediculus corporis, and Phthirius pubis. There are many others which prey upon man to a greater or less extent, but which are not strictly parasitic upon him, such as fleas, gnats, ticks, bedbugs, etc.

DEMODEX FOLLICULORUM.—This minute mite, which inhabits the hair follicles, needs only a mere mention, as it gives rise to no phenomena, is of frequent occurrence upon healthy skins, and requires no treatment.

SCABIES.—The symptoms produced by the presence of the itch insect (*Sarcoptes hominis*) upon the skin, are of two kinds: those caused directly by the animal itself, and those produced in consequence of the scratching of the patient. The males and immature insects make only a little pit in the cuticle, for purposes of nutrition or metamorphosis, which gives rise to a minute papule or vesicle. It is the impregnated female only which produces the pathognomonic mark of scabies, the burrow for the deposition of her eggs. These burrows appear as linear ulcerations of irregular course, with an uneven surface corresponding to the situation of the eggs within, and terminating in a marked prominence representing the position of the animal beneath the epidermis. In persons of cleanly habits, the burrows are generally distinguishable by their white color, but in working people they are mostly stained of a darker tint by the absorption of dirt. They vary in length from one or two lines to half an inch, but in exceptional cases they may exceed this measurement. Their direction is slightly zigzag, or curved, seldom perfectly straight. In some cases the whole burrow is lifted prominently above the general surface by the exudation beneath it. If the portion of epidermis in which the burrow is situated be cut out with a pair of curved scissors, and examined with a low magnifying power, it will be seen to pursue an oblique course downwards, and to contain numerous eggs, in various stages of development, broken egg shells, and an abundance of reddish fecal matter in small globular masses.

The name of the disease indicates plainly enough the nature of the subjective symptoms which characterize it: "the itch." The rambling of the insects over the surface, and the burrowing into the deeper sensitive layers of the epidermis, produce an irritation so intolerable as to make a resort to scratching an imperative necessity. This leads directly to the secondary phenomena of the disease, the eruptive appearances of scabies. In the beginning of the disease, the itching is very slight, but after a fortnight, when the young emerge from the burrows and begin to colonize fresh portions of the skin, it increases in intensity, and by the third week is no longer relieved by superficial friction. An excoriated papular efflorescence bears witness to the violent action of the nails. Finally, vesicles, pustules, patches of moist eczema, and ecthymatous eruptions follow. These appearances are most marked upon certain regions of the body—the chest, abdomen, thighs, buttocks, and hands—not the parts where the burrows are in greatest abundance necessarily, but those which are most accessible to the nails. In old cases, in addition to the above lesions, we may find ecthymatous sores of enormous size, with deep pigment stains and swollen glands, presenting the most varied manifestations of cutaneous efflorescence. A peculiar and rare form of the disease, in which the animals live in colonies beneath extensive crusts upon the surface of the skin, instead of burrowing into the epidermis, has been called "Norway itch." Such a radical change of habit on the part of the insects is inexplicable.

The favorite seats of the burrows are the lateral surfaces of the fingers, the wrists, nates, folds of the axillæ, and penis, while in infants they may be distributed over the whole surface. They do not affect the head. The secondary forms of eruption are much more widely spread. The most important points in diagnosis are the seat of the eruption, the great multiformity of the efflorescence, the aggravation of the itching while the patient is warm in bed, a history of contagion, or the occurrence of similar symptoms in several members of a family or amongst associates, and the presence of the characteristic burrows. From the latter, it is always easy to remove the old female, or some evidence of her presence, with a needle, or the young insects may be found, perhaps, in a vesicle or papule.

Scabies, in America, is a very fluctuating affection in point of frequency. In the early part of the present century, it was as prevalent among children as the exanthemata, but afterwards, and until the time of our civil war, had nearly disappeared. During the camp life of that period, it found the most favorable conditions for rapid development and general distribution. Soldiers returning on leave, transplanted it in their homes all over the country, so that it became a universal evil. Since then it has been almost exterminated, reviving to a slight extent, from time to time, in direct ratio to the amount of foreign immigration.

Treatment.—There are two distinct purposes to be accomplished in the treatment of scabies: one is to destroy the animal in all its phases of existence, the other to cure the cutaneous disturbances. Unfortunately, the first necessity can be effected by such remedies only as tend to aggravate the condition of the latter, so that in every individual case, the treatment must be prudently adjusted to meet these two objects. In many cases, preparatory treatment even is necessary in order that the inflammatory processes in the cutaneous tissues may be sufficiently reduced to bear the action of the parasiticide. In the majority of cases, however, the two objects may be accomplished simultaneously by a combination of methods. When the skin is greatly inflamed, covered to a large extent with excoriations and pustules, or in a state of acute œdematous eczema, vesicular and oozing, the methods already advised for the management of such conditions (see Eczema, p. 614), should be employed until the inflammation has been sufficiently reduced to endure the stimulating action of the other class of remedies. This will sometimes require a week or more.

The most active agents that can be used upon the skin for the destruction of the itch insect and its eggs, are sulphur and Peruvian balsam. They must be employed in such a way, however, that they will penetrate to the haunts of the insect within the epidermis, as well as upon its surface. The addition of an alkali is of material assistance in this direction, by removing the outer layers of cuticle, and such a combination forms the basis of all the so-called "quick cures" of the disease. The three most effective preparations of this class are: Helmerich's ointment (sulphur, two parts; carbonate of potassium, one part; lard, eight parts); Wilkinson's ointment (sulphur, oil of cade, green soap, and lard, equal parts); and Vlemingkx's solution (sulphur, two parts; caustic lime, one part; water, twenty parts. Boil down to twelve parts and filter).

The patient is first rubbed thoroughly over all affected parts with one of these, spread on a bit of flannel rag. He is then allowed to lie in a warm bath for half an hour, when the skin is rinsed in fresh water, and rubbed with some soothing ointment or simple lard wherever excoriations exist. This process is to be repeated for three or four nights in succession. The thoroughness of the applications is to be limited only by the endurance of the individual's skin, and the amount of inflammation it presents. No parts except the head are to be spared. Instead of the lard, in the Wilkinson's ointment, alcohol may be substituted, as recommended by Hebra, this giving greater penetration to the parasiticides in its composition.

These are the most powerful means of treatment, and are especially serviceable in cases of long standing and extensive distribution. The itching usually disappears after the first night's application. In milder cases, and in women and children, less severe measures may be employed, if desired—a mixture of sulphur and styrax, or Peruvian balsam, is generally effective, and not offensive or irritating. The following formula is a good one: R. Sulphuris ℥ss, balsami Peruviani ℥j, adipis seu vaselini ℥ij.—M. It is to be rubbed

thoroughly into all affected parts at bedtime, and, if possible, allowed to remain upon the skin all night. If too stimulating for such protracted action, it is to be washed off after an hour in a warm bath. This process is to be repeated for several nights in succession. Upon very delicate skins, the Peruvian balsam may be used alone, mixed with alcohol or olive oil. Whatever method is employed, it must be remembered that the secondary eruption remains to be treated, after the parasitic element of the disease has been exterminated. In mild cases this will disappear of itself, but in the severer and long-standing forms of the affection, it is necessary to apply the same principles of treatment as are required in eczema. It must also not be forgotten that a continuance of the use of parasiticides, after they have accomplished the destruction of the animal and its eggs, may provoke appearances which the physician creates while endeavoring to cure, and that the skin after a severe attack of the disease is often left in an irritable state for a long time. All underclothing worn next to the patient's skin, as well as the bed linen, should be put into boiling water on the first night of treatment.

PEDICULOSIS. (Synonyms: *Phtheiriasis ; Louse disease.*)—The lice which infect man are of three distinct species, and they inhabit distinct regions of the body. They are: the head louse (*Pediculus capitis*), the clothes or body louse (*Pediculus vestimentorum*), and the pubic louse (*Pediculus* or *Phthirius pubis*).

Pediculosis Capitis.—The head louse lives only upon the hair of the head, to which it attaches its eggs, popularly called "nits," and subsists by puncturing the scalp and drawing blood through the bite. It multiplies very rapidly, and produces great irritation of the scalp. In consequence of scratching or combing, acute eczematous inflammation of the scalp is often excited—Eczema madidans or Eczema pustulosum—so that the hair is glued together by the discharges, forming with the lice an indescribably filthy mass. The glands in the neck often become greatly swollen, and the eczema may extend from the centre of the scalp to its border, in all directions. A sympathetic eczema is often established about the ears, mouth, and nostrils, in children, even when the scalp is not visibly affected. Head lice are very common among the dirty classes of society, and often find their way to the most cleanly households, through the meeting of children at public schools, through the intercourse of wet nurses with lying-in women, and, no doubt, sometimes through accidental contact in public conveyances.

Treatment.—The most effective way of destroying head lice is by saturating the scalp and hair, throughout its length, with crude petroleum, and washing it off after two or three hours with soap and water. When dried, the hairs should be drenched with alcohol or cologne. This process should be repeated for two or three days in succession. The nits may remain attached to the shafts of the hairs for some time afterwards, but are harmless. They may be removed by scraping with knife or scissors. It is never necessary to cut the hair before treatment. Mercurial, stavesacre, and cevadilla ointments are often used to destroy the lice, but their effect is more uncertain than that of petroleum. The eczematous condition of the scalp, which remains after the destruction of the parasites, generally subsides rapidly, without treatment, but sometimes demands subsequent attention. All head coverings which have been worn in contact with the hair, should be cleansed by boiling or baking, or their linings should be destroyed. Combs and brushes may be cleansed with boiling water. They should never be used for the removal of the lice.

Pediculosis Corporis.—The body louse is, strictly speaking, a *clothes louse*, for it breeds upon the clothing, and only bites the skin to draw blood as its food. It is somewhat larger than the head louse, which it closely resembles. It lays its eggs in the folds and seams of the garments, and its eggs may be readily discovered by examining these parts. Its bite or puncture produces a minute, papular efflorescence, which by scratching generally exhibits a tip capped by dried blood. The whole surface of the body, excepting the head and hands, may be thickly covered in this way, with long scratch marks interspersed. The eruption is generally most marked upon the trunk, especially so upon the upper parts, front and back. When lice have infested the body for a long time, it may be during the whole life, as among the filthy races of some parts of Europe, the skin, in addition to this excoriated, papular eruption, may present much graver lesions, such as pustules, ecthymatous crusts, and extensive sores, and may gradually take on an intense degree of pigmentation, as the result of the long-sustained hyperæmia of its tissues. Such a condition has been called " vagabond's disease" (*Morbus erronum*).

Treatment.—This is to be directed to the clothes, not to the skin, which in ordinary cases rapidly recovers its healthy condition after the lice have been destroyed. All the clothing that can be so treated, should be thrown into boiling water, and the outer garments should be baked, or ironed along all their seams with as hot a flatiron as can be used without burning them. The bedclothing may be treated in the same way, but this is rarely necessary. The body may be thoroughly rubbed with soft soap, and soaked in a hot bath, before putting on fresh clothing. Mild, soothing ointments may sometimes be used upon the skin for a few days, with advantage, to quiet the irritability of its nerves.

Pediculosis Pubis.—The pubic louse (*phthirius*) differs materially in shape from the pediculi of the head and clothes, being shorter and broader. It attaches itself to the hairs of the pubic region, and to those of the legs and surface of the abdomen, in hairy men. It is found also in the axilla, and, in rare cases, even upon the eyelashes. It has a reddish color. Its eggs are attached to the hair in all these regions. It draws blood from the skin at the roots of the hairs, and produces great irritation, in consequence of which a papular eruption is developed, and often acute eczematous inflammation. Pubic lice are generally acquired during impure sexual intercourse,

Treatment.—These lice may be destroyed by smearing the parts, if not too extensive, a few times with mercurial ointment, but better generally by the use of petroleum, in the manner described in speaking of Pediculosis capitis.

NOTE ON THE PATHOLOGY OF LEPROSY.

In 1873, Hansen called attention to the presence of bacteria in leprous tissues. Within the last year or two this subject has received particular study from many observers, especially Neisser, Cornil, and Suchard. According to these writers, the same forms of bacilli have been found in leprous neoplasms derived from patients in many parts of the world where the disease exists. These organisms are staff-like or rod-like bodies, having a length of from half to three-quarters that of a red blood corpuscle, and a breadth one-fourth of their length. They occupy the large round cells, which are so abundant in the fibrous structure of the skin in leprous tubercles, distending the protoplasm at times by their great numbers. They are arranged in parallel rows, or are placed end to end in chains of two or three. They are not found in any epithelial tissues nor in the bloodvessels.

Neisser draws the following conclusions from his investigations : Leprosy is a true bacterial disease, caused by a special bacterium. The bacilli appear in the tissues as such, or more probably as spores, and remain for a longer or shorter time, according to circumstances, in a state of incubation in depots, perhaps in the lymph glands. This period of incubation, much longer than in other infectious diseases, is in proportion to the physiological resistance of the human organism compared with the feeble developing power of the bacilli. It, as well as the course of the disease, is shorter in tropical countries than in Europe. From these depots, the disease extends throughout the body ; in those portions of the skin most exposed, the face, hands, elbows, and knees ; and in the peripheral nerves (anæsthetic form). The other organs are less freely invaded. The bacilli excite inflammation, and by a specific action transform the migrating cell into a leprous cell. Leprosy is probably an infectious disease, and its specific products are contagious, viz., the leprous cells of the tubercles, the tissue fluids, and pus containing bacilli and spores. On the other hand, all pus may not be infectious, as the fluid contained in leprous bullæ is not. Leprosy is not hereditary.

DISEASES OF THE CELLULAR TISSUE.

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AN "atmosphere of areolar tissue" envelops all the organs, as well as the component elements of each organ. As the *tela cellulosa*, it extends in one continuous subcutaneous layer from head to foot, sending in prolongations which support, strengthen, and give shape and consistency to every part. A tissue like this, having so unusual a dissemination, and having such close relations to bloodvessels, nerves and lymphatics which traverse its meshes, must necessarily be the seat of varied and complex pathological phenomena, interesting alike to the student and practitioner. Yet, strange to say, there is nowhere any practical classification which might serve as a guide in the investigation of such affections. Some of the diseases of the areolar tissue are described in surgical works under the head of abscess, which is only one of many equally important results of inflammation of this tissue. Others receive a passing mention when they form connecting links between morbid changes in neighboring organs; and in a few instances the affections are designated by names which have little or no relation to the anatomical site of the disease concerned, or to the pathological changes which take place. The limitations of this article necessarily exclude many diseases of the cellular tissue which come under the care of the physician and gynæcologist; and also curtail to some extent the completeness of description which would be necessary in a work devoted solely to the subject.

The diseases of the cellular tissue which belong to the domain of Surgery may be advantageously classified as follows:—

(1) Inflammation of the cellular tissue, which may be either *simple* or *malignant*. The former may be either diffused or circumscribed; the latter is always diffused. The circumscribed varieties of *cellulitis simplex* are: (a) Peri-venous Cellulitis; (b) Peri-arthritic Cellulitis; (c) Ischio-rectal Cellulitis; (d) Peri-urethral Cellulitis; (e) Peri-phalangeal Cellulitis; (f) Peri-cæcal Cellulitis; and (g) Orbital Cellulitis.

(2) Gangrenous Cellulitis.
(3) Phlegmonous Erysipelas.
(4) Hypertrophy (Myxœdema).
(5) Atrophy.
(6) Tumors of the Cellular Tissue.
(7) Parasitic Affections of the Cellular Tissue.

Gangrenous cellulitis or carbuncle, phlegmonous erysipelas, and tumors of the cellular tissue, are described in other articles, and will not therefore be touched upon here.

DIFFUSED SIMPLE CELLULITIS.

Simple diffused inflammation of the areolar tissue may be either acute or chronic. The acute form is the most common. The chronic is generally seen in connection with old ulcers and badly treated wounds in uncleanly persons. Occasionally it follows the acute variety. It is rarely, if ever, the result of blood-poisoning. In this particular it differs from malignant cellulitis, which invariably results from a septicæmic condition.

LOCALITY.—The most frequent seat of *cellulitis simplex* is in the cellular tissue of the upper and lower extremities. Among the predisposing causes of the disease are: the use of innutritious food, impure air, mental distress, venereal excesses, or the prolonged abuse of alcoholic liquors. The most frequent of the exciting causes are exposure to cold and traumatism. In the upper extremity, idiopathic cellulitis usually attacks the inner and anterior aspect of the arm and forearm. In the lower extremity, it is found generally on the outer and anterior portions of the leg. It is not infrequently met with at the upper part of the thorax near the axillary region, at the lower portion of the abdominal walls, and in the areolar tissue around the gluteal muscles. Traumatic cellulitis may occur in any part of the body at the seat of injury.

SYMPTOMS.—At the onset of the inflammation there is a soreness of the affected part, with occasional shooting pains, deep-seated, and accompanied by slight swelling and hardness of the tissues under the integument, without any perceptible redness. The involved limb feels stiff, and some pain is present at every movement. The pain soon increases in severity, and the swelling and hardness become more perceptible. The tumefaction is often irregular in shape, with patches between the swollen spots, which, though inflamed, are softer, gradually shading off into the surrounding tissues. When the disease is fully developed this irregularity may disappear, and the surface becomes smooth and glistening. In cases where the lymph coagulates in the vessels, the hardness and roughness, unaccompanied in many cases by redness, remain through the disease, and for some time after all acute symptoms have passed away. With the acute swelling and infiltration of the tissues by inflammatory products, there is a more acute and throbbing pain than before, and the limb cannot be moved without great suffering. Suppuration is announced by the occurrence of chilly sensations or rigors, and by a softening of a portion which was previously hard and tense, and by fluctuation. The suppuration occurs in patches, which finally blend, and form long, irregular, subcutaneous sinuses that communicate with each other, and are exceedingly difficult to heal.

When, on account of the depth of the pus from the surface, fluctuation cannot be ascertained with any degree of positiveness, dependence must be placed on the occurrence of rigors, the subsidence of acute pain, and the fact that the pits made in the tissue by pressure are exceedingly deep, but do not remain as long as those made when simple inflammatory œdema is present.

The anatomical changes consist in a varicose dilatation of the capillary bloodvessels of the inflamed district, and in some portions a breaking down of their walls—the adjacent parts of the still intact vessels being closed by coagula, and by pressure from without of the various exudates. The connective tissue cells are found in various stages of proliferation, and wandering cells (white blood-cells) infiltrate the inflamed tissue throughout its whole extent. The inter-cellular substance is opaque and shreddy, filled with cells, and sometimes with minute masses of blood which have escaped through the softened

wall of a capillary vessel. As in other inflammations, the chlorides and phosphates are in excess. A large amount of lymph and serum is also present. At a later period collections of pus are scattered through the inflamed part, and shreds of necrotic tissue are interspersed with the various exudates.

There is always more or less febrile disturbance during the progress of the disease. Its extent varies with the amount of tissue involved in the inflammatory action. The temperature rises from one to three degrees. The pulse is increased in rapidity, rarely rising, however, above one hundred and ten, except in very nervous persons, when it may reach one hundred and twenty or one hundred and thirty beats per minute. The tongue is coated with a whitish fur in the early stages, but afterwards may assume a brownish color, especially if the patient's power of resistance be feeble, or if there be much suppuration going on. There are some headache and pain in the back, and the bowels are usually constipated. Chills are present when pus forms.

In the subacute or chronic form of simple cellulitis there are no constitutional disturbances of any importance. Neither is there any special amount of pain, except when the involved limb is moved, or when pressure is made. The tissue is hard, dense, and roughened, and there is more discoloration of the integument than there is in the acute form.

DIAGNOSIS.—Cellulitis simplex is readily diagnosed from *phlegmonous erysipelas* by the absence of the purplish redness and of the burning, throbbing pain, which characterize the latter affection. In cellulitis simplex there is, as a rule, comparatively slight fever, and the general distress is much less, in every way. In phlegmonous erysipelas the febrile symptoms are of a much graver type, and in the latter also there are constitutional symptoms before the local manifestations, while in simple cellulitis the local symptoms always precede the constitutional.

Cellulitis maligna is readily distinguished from cellulitis simplex by the very rapid extension of the inflammatory action, the great tumefaction of the diseased limb, the accompanying lymphangeitis and lymphadenitis, and the exceedingly grave constitutional disturbance which attends it, and by recurring to the fact that malignant cellulitis follows the introduction of some septic material into the circulation.

TREATMENT.—This should be both local and constitutional. A mild mercurial or saline purgative is necessary at the onset, to produce a complete evacuation of the intestinal canal. The cathartic should be followed by large doses of quinine (twenty to forty grains daily) for three or four days, unless there is some special contraindication to its use, in the shape of an irritable stomach or headache. In such cases, ordinary tonic doses may be given with safety. This drug is often effective in cutting short the inflammatory action, and in limiting the extent of the suppurative processes. When the use of quinia is undesirable, and the fever is of a low type, beef-tea and wine will be found an efficient substitute. If the temperature runs high, the tincture of aconite in minute doses (one-fifteenth of a drop), repeated every half hour, may be given with benefit. When suppuration has commenced and the fever has subsided to some extent, the muriated tincture of iron should be administered in large doses. It may be given combined with the tonic doses of quinia. Opiates are not advisable unless there is great restlessness and inability to sleep, and even in such cases, alcohol in some form at bedtime is preferable. Sponging the surface of the body with tepid water and alcohol, with gentle friction of the affected limb, some distance from the seat of inflammation, will often relieve the pain and restlessness and promote sleep, without the assistance of any drug.

In the local as well as in the general treatment, attention must be given to the idiosyncrasies of the patient. It is well to remember that "what is one man's meat is another man's poison." If the patient has had a previous attack of cellulitis, it will be useful to learn whether hot applications were more soothing than cold ones, or *vice versa*. When the system is not depressed, and the general condition is good, cold applications to the part by means of rubber ice-bags will often allay the pain, diminish the swelling, lower the general as well as the local temperature, and limit the disease. If the patient is very sensitive, the ice-bags may be separated from the integument by a folded towel. These cold applications may be continued until suppuration supervenes; when that occurs they should be discontinued.

If the patient is very weak, and if any purplish discoloration of the integument is present, indicating a tendency to stagnation of blood, cold applications will not answer. They are also contraindicated in subacute or chronic cellulitis, because they conduce to the formation of gangrenous sloughs, and retard the return to a healthy state. In all such cases hot applications are the best. Pieces of heavy blanket or folded towels, dipped in hot water, may be applied, and frequently changed. When the cloths are wet, a few drops of laudanum, or of the *lotio plumbi et opii*, may be poured on the surface next to the skin. This preparation acts in conjunction with the hot water, in exerting a sedative effect, and in relieving the pain. Some recommend clay poultices, in all stages of the disease. Poultices made of linseed meal, slippery elm, bran, etc., are also used. Charcoal poultices are excellent when suppuration is going on.

As the areolar tissue is readily permeated by the exudates, and as the pressure of the exuded material on the bloodvessels of the part soon cuts off the supply of nutriment and causes necrosis of the inflamed tissue, it is well, in the early stages of the disease, to resort to free incisions; and since, as before remarked, the tendency in all cases of cellulitis is to early suppuration and the formation of sinuses which are exceedingly difficult to heal, the use of the knife is indicated before pus forms, while the acute stage is at its height. Leeches or cathartics will not answer the purpose. Early and free incisions will generally retard the disease, and prevent extensive suppuration and the formation of sinuses.

Some surgeons object to early incisions, on the ground that the bloodvessels opened by the knife afford a means of contamination to the general system by pus and poisonous germs; but this objection would be as rational at any period of the disease, and would prevent incisions even after the formation of pus. It must not be overlooked that the destructive poisons at work in the interior of the diseased tissue break down the walls of the lymph channels and capillary bloodvessels, produce coagula in veins, and confine a mass of poisonous material where it can gain a ready access to the general circulation and excite serious constitutional changes. If early incisions are made, and if the parts are afterwards thoroughly cleansed with carbolized water, no danger from blood-poisoning need be apprehended; indeed, experience shows that there is much less danger than when purulent formations are allowed to take place, and the pus is permitted to burrow in the neighboring tissues.

When the parts have been sufficiently incised, a poultice, made of equal parts of linseed meal and charcoal, should be applied for three or four days. At the end of that time frequent syringing with carbolized water, or with a solution of chloral hydrate (five grains to the ounce), will be sufficient. When granulations spring up, a dressing of balsam of Peru will be of advantage.

Another good method of treatment, which has been employed with success in traumatic cellulitis, is to immerse the inflamed limb in a tin or zinc basin filled with water at blood-heat, or as high as 110° F.; when suppuration has commenced carbolic acid may be added to the water. The limb

may be left in the bath during the whole course of the disease, both before and after the incisions are made. The water should be changed twice in twenty-four hours, and the sinuses and incisions thoroughly syringed each time.

In the chronic form of simple cellulitis, frequent rubbing with oleate of mercury, and strapping, are all that is necessary in the way of local treatment. Cod-liver oil and iron should be given, and a strong diet, until the disease is cured.

CIRCUMSCRIBED SIMPLE CELLULITIS.

The most common forms of circumscribed cellulitis which come under the care of the surgeon are, as already mentioned:—

<div style="text-align:center">

Peri-venous cellulitis.
Peri-arthritic cellulitis.
Ischio-rectal cellulitis.
Peri-urethral cellulitis.
Peri-phalangeal cellulitis.
Peri-cæcal cellulitis.
Orbital cellulitis.

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PERI-VENOUS CELLULITIS, erroneously denominated *suppurative phlebitis*, is a comparatively rare form of disease, and, with the exception of peri-cæcal cellulitis, is much graver in its consequences than the other varieties. The gravity of peri-venous cellulitis arises from the close proximity of the inflammation to the venous channels, and to the destruction of the walls of the veins, through the absence of their supply of nourishment in consequence of the small vessels which supply the walls with blood being pressed upon and closed by the inflammatory exudation. The destruction of the walls of the veins allows pus and other forms of degenerated material to enter the general circulation, and thus excite pyæmia, which not infrequently accompanies this form of cellulitis.

Peri-venous cellulitis, like other forms of cellular inflammation, is likely to occur in persons whose vitality is depressed, and who, while in that state, are accidentally or surgically injured in the neighborhood of a vein. It may accompany any form of injury or operation on the extremities, but is especially apt to accompany lacerated or torn wounds. It usually commences around some of the smaller veins, and extends upward to the larger branches until the main trunk is reached. The inflammation travels with great rapidity, and death of tissue occurs sooner than in any other form of simple cellulitis. The exudation of inflammatory material is similar to that previously described, and the pathological changes generally are the same, with this exception : coagulation of blood occurs in the veins, consequent upon obstruction to the circulation through them ; and the œdema of the extremity, at a distance from the seat of inflammation, is due to the same cause.

Symptoms.—The symptoms usually are not well marked during the first twenty-four or forty-eight hours. During that period there are some pain and swelling of the affected part, not well defined. On the third or fourth day the redness is increased, and the swelling and hardness reach their maximum over and around the venous trunk. The exudates around the vein and the coagulum within the vein make the whole feel like a cord under the integument. If the vein is deep-seated, a diagnosis may be made by noting whether the inflammation follows or does not follow the course of a vein.

As before stated, the exuded materials and the tissue in which the inflam-

matory products lie soon degenerate into pus. Sometimes the purulent formation occurs in isolated masses along the course of the vein, but generally it is continuous up and down the inflamed tract. If nature has closed the broken-down veins, as is usually the case, little or none of the products of disintegration enter the circulation, and the constitutional symptoms, though somewhat graver than in other forms of cellulitis, will have no special significance, consisting merely of an increase in the temperature of the body of from one to three or four degrees, a pulse varying from ninety to one hundred and ten or one hundred and fifteen, loss of appetite, severe headache and lumbar pain, and a thickly furred tongue. If, however, the suppuration is extensive, and the venous channels permeable, decomposing materials may enter the system; then symptoms will be developed akin to those which arise in pyæmia—indeed, they are in many cases nothing more nor less than pyæmic symptoms—and the disease will be likely to terminate fatally.

Rigors in all such cases are well marked. The temperature rises rapidly to 105° F. or 107° F. The pulse becomes weaker, and more rapid and compressible, and the face assumes an anxious expression; the tongue is dry and coated with a brown fur, and in the worst cases sordes form on the teeth early in the disease. In such cases we may expect a fatal termination.

Treatment.—In peri-venous cellulitis, even more than in the other forms of cellular inflammation, early incisions and the thorough cleansing of the tissues with carbolized water are of the greatest value in cutting short the disease, and in limiting the suppurative process. It is not advisable to wait until pus forms before cutting into the inflamed tissue on one side or other of the veins. The persistent use of carbolized water and charcoal poultices will do away with all danger of blood-poisoning from purulent formations. Some recommend the application of leeches over the inflamed vein, and cathartic medicines at the outset of the disease. In conjunction with hot applications they are often beneficial, and they may be tried when the patient dreads the knife. Tincture of iodine is also of some service; it may be applied with a camel's-hair pencil morning and evening over the inflamed surface. Ointments of mercury, belladonna, and opium are also employed.

Quinine and stimulants should not be omitted in the treatment. The stimulants may be best administered with milk in the form of "milk-punch," or with eggs beaten up as "eggnog." In all cases, nutritive materials should be administered with the stimulants, and the quantity administered should be regulated by the condition of the patient's stomach. If the stomach will not bear the combination of milk and stimulants, a goblet should be partly filled with small pieces of ice and a tablespoonful of brandy; a little Seltzer water added to this will make a very acceptable drink, which, in moderate quantities, is usually tolerated by an irritable stomach. The sulphide of calcium has been recommended to diminish the amount of suppuration. It is apt to disorder the stomach. Carbonate of ammonium in ten-grain doses is said to prevent the formation of coagula in the inflamed veins. I have given it as a diffusible stimulant in cases where great depression existed, and have obtained good results; but its reputed value in preventing the formation of clots is open to question.

Peri-Arthritic Cellulitis is an inflammation of the cellular tissue around the joints. The disease is of frequent occurrence in scrofulous children, though it is not uncommon in delicate adults. The most frequent causes are injuries, exposure to cold, and extension of inflammation from a diseased bone or joint. The pathological changes are similar to those already described under the head of diffused cellulitis.

Peri-arthritic cellulitis exhibits a preference for the cellular tissue over the knee and shoulder-joints. It commences with soreness about the joints, especially noticeable on movement of the limb. The pain on pressure extends beyond the locality of the joint. There may or may not be redness of the integument, but there are always the same tension and hardness which are found in other forms of cellulitis.

The disease is readily diagnosed from inflammation in the interior of the joint. In peri-arthritic cellulitis the swelling is continuous over the joint, and covers up the bony prominences around it. The swelling over the articulation is evenly distributed, and is not found in excess where the synovial membrane is uncovered by ligaments, as is the case in synovitis. There is no fluctuation in cellulitis until pus forms, and then it is not confined to the limits of the joint, while there is usually distinct fluctuation in synovitis. The joint surfaces may be forcibly approximated in cellulitis without occasioning any pain, while in inflammation of the joint there is usually considerable pain. The pain on pressure, in synovitis, is intense when the fingers press directly on the inflamed membrane, between the ligaments. In peri-arthritic cellulitis the pain is diffused over the whole surface. In cellulitis there is a feeling of hardness in the tumor, altogether absent in synovitis.

Treatment.—The limb involved should be kept motionless by the application of a well-padded splint, and hot applications should be made as previously directed. Indeed, the whole system of treatment recommended in simple diffused cellulitis is applicable here also, with this difference: great care must be exercised in making the incisions so as not to wound the structures entering into the formation of the joint.

Ischio-Rectal Cellulitis is an inflammation of the mass of cellular tissue situated between the anus and the tuberosity of the ischium. It is usually an acute disease, and is liable to occur at any age from local exposure to cold, such as sitting on the ice after skating, or on stone steps or stone pavements. It occurs also from traumatism, and from the extension of ulceration through the gut into the cellular tissue, and the subsequent entrance, through the ulcer, of irritating materials from the rectum.

The disease generally commences with acute pain on the affected side near the anus, extending up the rectum or down the thigh; the pain is aggravated by pressure from the outside, or by pressure of the finger in the rectum. There is considerable swelling over the fossa, which is also perceptible by a digital examination of the rectum. As the disease advances, the inflammatory swelling becomes hard and prominent; there is a frequent desire to go to stool, owing to the presence of inflammatory exudation on the rectal wall, which causes a sensation similar to that produced by the presence of feces. The formation of pus is made known by chilly sensations and rigors. The pus burrows where there is least resistance, and in this locality the least resistance is in an upward direction. The pus burrows underneath the levator ani muscle, upwards and around the rectum. It may by its presence produce necrosis of a portion of the wall of the rectum, and establish a fistulous communication to and through the integument. The pus may make its exit externally an inch or an inch and a half from the anus, and somewhat posterior to it, or it may open over the tuberosity of the ischium, or on the inner side of the thigh, or in the perineum.

Treatment.—As the great danger in ischio-rectal cellulitis is in the formation of a fistulous communication with the rectum, the efforts of the surgeon should be directed to the one end of cutting short the inflammation and preventing the burrowing of pus. If the patient is seen at the beginning of the disease, a brisk saline purgative should be given; when the bowels have

been freely moved, if the patient is strong enough to bear the loss of blood, half a dozen leeches may be applied over the inflamed part, and free bleeding promoted by hot fomentations. Twenty or thirty grains of quinine should be given at the same time, in one dose, or in divided doses within two or three hours. If the pain and swelling continue, a deep incision should be made without delay into the inflamed tissue of the fossa, whether pus has or has not formed. If the disease has existed three or four days before the attention of the surgeon is called to it, no time should be wasted with leeches or poultices, but an incision should be made large enough to prevent all burrowing of pus in an upward direction. If the incision is made sufficiently early, a fistula in ano will not occur. Even in cases where the cellulitis is the result of ulceration of the bowel and the subsequent escape of fecal matter into the cellular tissue, an early incision will limit the destruction of tissue around the anus and rectum. When the incision is made, charcoal poultices are to be applied for two or three days, or while there is a free purulent discharge externally. Every time that the poultice is changed, the wound should be washed with carbolized water or other disinfecting material. When the poultices are discontinued, the carbolized water dressing (two per cent. solution) will generally be sufficient to keep the wound clean, and to promote the growth of granulations.

As the wound made by the surgeon is at least an inch in depth, it will be necessary to pack it from the bottom after each washing, with charpie wet with carbolized water, carbolized oil, or balsam of Peru. When the granulations are full and flabby, as they often are in this situation, the solution of chloral hydrate or potassium permanganate may be sometimes advantageously substituted for those previously mentioned.

In all cases where the system is depressed, tonics and cod liver-oil are very useful adjuvants in the treatment.

If a communication between the rectum and the external integument has been established, the whole fistulous tract should be laid open without delay. It is better to make one operation of the whole, than to wait two or three weeks or months, as is usually done, for the cellulitis to subside, and then to open fistulous tracts. The prompt and efficient opening of the whole fistula will shorten the period of confinement to bed, and diminish the sufferings of the patient.

Peri-Urethral Cellulitis may arise from injuries or operations on the urethra or perineum. There are two forms of this disease, viz., one in which the inflammation occurs in small isolated patches in the penile portion of the urethra; and a second, in which it forms one continuous mass between the layers of the triangular ligament behind the bulb. In the former, the inflammation occupies, in the majority of cases, the neighborhood of the glans penis. It may arise from contusion or from straining during prolonged and violent sexual intercourse, or from laceration of urethral fibres during an attack of chordee; or it may follow an attack of gonorrhœa when there is no history of injury during copulation. This, however, does not preclude the possibility of injury having occurred. I am inclined to the opinion that all cases, whether occurring with or without gonorrhœa—except those following chordee—are the result of contusion in sexual intercourse.

The symptoms are obscure at first, especially if the cellulitis is accompanied by gonorrhœa, because the scalding which occurs in the latter during micturition, and the soreness during the intervals of micturition, obscure the circumscribed pain of the former affection. The first abnormal symptom which generally attracts the attention of the patient is the formation of a small, hard mass close to the urethra, ranging in size from the bulk of a pea to that of a

hazel-nut. It is painful on pressure, and there is also considerable pain during erection and micturition—the pain being centred over the hardened spot previously mentioned. Occasionally the cellulitis extends up and down the canal in the median line for an inch or two, the swelling occupying the median line, and being symmetrical in its whole length. Suppuration is apt to occur in the majority of cases, though not as often as in cellulitis between the layers of the triangular ligament. In many instances a lump of inflammatory exudation remains from one to three months, and is finally absorbed without doing any special injury to the urethral canal.

The second form of peri-urethral cellulitis is confined to the perineal portion of the urethra, between the layers of the triangular ligament. It often originates in the cellular tissue around Cowper's glands, but it may start further back. The inflammation is much more extensive than in the first variety, on account of the greater amount of cellular tissue involved, and its looser connections; and the disease generally ends in suppuration. It is sometimes the result of blows or falls on the perineum. It may also be caused by a small point of follicular ulceration behind a stricture. The ulcer gradually extends, piercing the urethral wall; as it progresses, its internal orifice becomes occluded by plastic exudation, while the inflammation spreads rapidly in the cellular tissue between the layers of fascia.

The symptoms, though well marked, are often attributed to other causes. There is pain in the perineum, more severe during micturition than at any other time; it may occupy one side or the other of the median line, and it extends to the inner side of the thigh and down to the anus. As in other forms of cellulitis, it is aggravated by pressure. As the disease progresses, a hard, well-defined swelling is found, generally on the right side of the median line; this gradually extends until the perineum is equally distended on each side of the raphe, and a well-marked tumor formed. In some cases the exudation is in sufficient quantity to close the urethral canal and cause retention of urine; or, if the pressure does not close the canal, it may cause ulceration of the urethra, and give exit to the pus in that way. This is a common occurrence, especially in neglected cases, and the inevitable result is a urethral fistula, which, however, generally closes without any further surgical interference than is mentioned hereafter.

Treatment.—In both forms of peri-urethral cellulitis, the bowels should be kept free with mild laxatives. A mixture consisting of an ounce each of Epsom salts and cream of tartar to one pint of water, may be given in two-ounce doses every morning; if the patient is very plethoric, a wineglassful may be given the first day every hour, until five or six doses have been taken; afterwards, the two-ounce dose in the morning will be all that is necessary. When the cellulitis is in the penile portion of the urethra, the parts may be bathed frequently in cold water; after each bath the penis should be wrapped in several folds of wet linen, or covered with a wet towel, with a layer of oiled silk tied on over all. Cold sitz-baths at night are also beneficial. In addition to the cold-water treatment, the integument over the inflamed spot may be painted daily with tincture of iodine, or with a saturated solution of nitrate of silver, until the epithelium is destroyed and the skin somewhat sore; these applications may then be postponed for a few days, to be resumed when the skin has healed. Oleate of mercury is also an excellent local remedy to promote absorption; it too may be rubbed in daily until the skin becomes sore.

Iodide of potassium is of service in cases where the stomach tolerates its use; it may be advantageously combined with tonics.

As before remarked, penile, peri-urethral cellulitis does not result as frequently in suppuration as the perineal variety. With proper care, the knife

is seldom called for. Incisions should not be made, moreover, for obvious reasons, in these cases, until pus forms and is plainly perceptible; then as small an incision as is compatible with free drainage should be made, and the abscess washed out in the usual manner. The cold-water dressings may be continued throughout the whole course of the disease.

The treatment of the perineal variety of peri-urethral cellulitis is the same as advised in ischio-rectal cellulitis, viz., leeches and cathartics to cut short the inflammation, and early incisions through the dense fascia into the inflammatory swelling, in order to insure the escape of pus externally and save the urethra from perforation. Half a dozen leeches should be applied over the perineum, followed by hot applications, to promote bleeding and absorption. If the patient is anæmic, both leeches and cathartics may be dispensed with. The incision should be made over the centre of the swelling, whether that centre occupies the median line of the perineum, or is situated at some distance from it. If the urethral wall has already been perforated, it is well to find the opening, and incise the urethra above and below the perforation. To incise the urethra in the median line at a distance from the false passage is not good surgery. By including the ulcerated opening in the incision, a much more rapid cure will be effected, and the continuance of a urethral fistula probably prevented. If any strictures exist in the canal, they should be cut or dilated. The antiseptic washes previously described are also indicated here under all circumstances.

PERI-PHALANGEAL CELLULITIS, sometimes called *paronychia*, *felon*, and *whitlow*, is an exceedingly common form of inflammation. It may be located in the subcutaneous cellular tissue, in the fascia that retains the tendons in position, or in the cellular tissue connected with the periosteum and bone. It is probable that many of the more severe forms of the disease originate in the periosteum. Occasionally the inflammation is confined to the cellular tissue around the margin of the nail, and in common parlance is known as a "run-around." This is the mildest form of peri-phalangeal cellulitis, and is rarely followed by serious injury to the bone or ligamentous structures. The principal cause of peri-phalangeal cellulitis is injury of the affected member, when the blood of the patient is impoverished from poor diet, bad air, dissipation, etc. It usually commences on the palmar aspect of the finger, with a sharp or intense pain, and slight swelling of the pulp of the finger. The pain increases in intensity, and the swelling extends to the sides and back of the phalanx. The whole surface of the inflamed part becomes exceedingly tense, hard, and painful on pressure. After the third or fourth day the pain assumes a throbbing character, and is almost unbearable. The patient can neither rest nor sleep; there is very little febrile excitement, the temperature seldom rising more than a degree, and the pulse often remaining normal throughout the disease. Pus forms in five or six days from the commencement of the attack; if allowed to burrow under the tight fibrous bands which cross the tendons, it soon destroys the periosteum and leads to necrosis of the bone. In virulent cases the morbid process rapidly extends, involving successively the cellular tissue of the hand and arm, destroying such an amount of tissue as to permanently impair the usefulness of the whole limb, and perhaps causing a fatal termination. Very many cases of peri-phalangeal cellulitis result in caries or necrosis of the phalanx, but such results generally arise from neglect on the part of the patient or surgeon.

Treatment.—For a day or two, a hot linseed-meal poultice, changed frequently, does excellent service. If the patient is seen three or four days subsequent to the beginning of the inflammation, the first thing to be done is to cut down through all the inflamed tissues, on the palmar aspect, to the bone. A simple

incision through the integument will not answer, not even in those cases where the disease seems to be limited to the subcutaneous cellular tissue. In all cases the bone should be touched by the edge of the knife. By this means all the tension made by the exudates and proliferation of cells will be relieved. The intense pain will be removed in a few hours, the pus that forms will find a ready outlet, and the finger will be saved from all distressing sequelæ.

It is also good practice to make a free incision in old cases where the pus has already made an exit for itself externally; this procedure hastens a favorable termination, and limits the destruction of bone, which, in such a case, has probably already commenced.

All incisions should be followed by hot poultices, and by thorough cleansing with antiseptic solutions when the wound begins to granulate. Gentle pressure should be made around the phalanx by means of adhesive plaster or a finger bandage. This should be tight enough to close somewhat the gap on the finger, but not tight enough to interfere with the circulation.

Peri-Cæcal Cellulitis (*Peri-typhlitis*).—This disease is of much more frequent occurrence than was formerly supposed. Modern methods of investigation have rendered its diagnosis a matter of certainty, and placed its treatment on a practical and scientific basis. In the majority of cases the disease results from the impaction of some foreign body in the appendix vermiformis or walls of the cæcum; ulceration ensues, and an opening is made in the wall, through which the foreign body makes its way into the cellular tissue outside. Fecal matter is apt to pass through also. In such cases the inflammation is much more severe and dangerous than when caused simply by the presence of a cherry stone, peach pit, or other foreign material of a similar character.

Peri-cæcal cellulitis nearly always terminates in suppuration. A second attack is not as apt to be followed by suppuration, as the first. Second attacks do not arise, as a rule, from perforation of the gut, but are due to slight injuries of the organized mass of lymph which resulted from the first inflammation.

Symptoms.—In peri-cæcal cellulitis the symptoms are not at first very well defined. Usually the patient complains for several days of colicky pains in the bowels, not confined to the vicinity of the cæcum, but shooting across the lower part of the abdomen. There are also disordered digestion, loss of appetite, and flatulence. The patient is restless and uneasy, and at night is feverish and unable to sleep; the pain is aggravated while at stool, but subsequently passes away, leaving the patient for a few hours comparatively comfortable, and seemingly free from any serious affection. If pressure is made during this interval, it will give rise to more or less pain. Very soon all the symptoms return with increased activity, and in the course of a week from the commencement of the disease, careful palpation over the involved organs will show a swelling, not well defined in outline, hard and painful to the touch, and deep-seated. Steady pressure over it causes starting pains in other portions of the abdomen. The febrile symptoms at this time are also well marked. The temperature varies from 101° F. to 103° F., seldom rising higher unless some complication is present, and the pulse ranges from 105 to 120. The tongue is coated and the face somewhat anxious. The stomach is irritable, and in some cases little or no nourishment can be retained. Constipation alternates with diarrhœa throughout the disease. The bladder is irritable, and there are frequent calls to urinate, each urination being accompanied by more or less pain. In a day or two longer all the symptoms are aggravated, the lesion is perceptible on inspection in the iliac region, and is

very painful and tender to the touch. When the finger is introduced into the rectum, a hard, well-defined swelling will be felt high up in the right side, and posteriorly.

Chills and rigors, as in other cases, indicate the formation of pus, and these signs of purulent formation may be accompanied by a perceptible and rapid increase in the size of the tumor, without fluctuation. Indeed it is almost impossible to detect fluctuation on account of the thickness of the walls which inclose the pus, and the additional covering made by the abdominal muscles.

If left to nature, the pus may make its exit through the rectum, or into the colon high up, or it may rupture into the bladder or peritoneal cavity. It generally makes an opening in the wall of the rectum. This is the most favorable road that the matter can take, such cases often terminating in recovery. If the abscess ruptures into the peritoneal cavity, the accident may be recognized by the occurrence of a sharp pain at the seat of rupture, tympanites, vomiting, and collapse. It is always fatal. If the pus perforates the rectum, there will be a purulent discharge per anum, accompanied by a sudden diminution in the size of the tumor. When the bladder is perforated, which is a rare occurrence, pus in considerable quantity will be distinguished in the urine.

Treatment.—If a diagnosis is made early in the case, castor oil should be given in quantities sufficient to produce several large evacuations from the bowels. The colon near the seat of inflammation often contains hard masses of fecal matter, which aggravate by pressure all the unfavorable symptoms. Free catharsis, therefore, is in nearly all cases necessary. An ice-bag may then be applied to the part, and a large dose of quinine given internally. Should the inflammatory symptoms continue in spite of these measures, and the swelling be well defined in the iliac region, an incision should be made without any further delay. As the purulent matter is altogether external to the peritoneum, and as the latter is not involved in the operation, there is little or no danger attending it.

The incision should be made over the highest part and centre of the tumor, parallel with Poupart's ligament. It ought not to exceed three inches in length, on account of the tendency to hernial protrusion when the abdominal walls are weakened by larger cuts. From two to three inches is sufficient for all purposes. When the integument and aponeurosis of the external oblique muscle have been divided, it will facilitate matters if a hypodermic syringe is introduced into the tumor, to determine the exact locality of the pus. If the syringe is inserted before the parts mentioned have been cut, it will be hard to find the purulent collection. When the syringe is withdrawn, the cutting may proceed in the same direction as the external incision, and of a similar length, until the cavity of the abscess is reached. The discharged pus has usually a strong fecal odor, and an examination of it may determine the nature of the foreign body which excited the inflammation.

The abscess is to be thoroughly cleansed with a 1–40 solution of carbolic acid, a drainage-tube inserted, and the edges of the wound drawn together with a few catgut sutures. In some instances it is necessary to leave the wound open for several days in order to keep it free from all purulent or fecal collections, or to pack it from the bottom with carbolized charpie after every washing.

A full dose of opium may be administered after the operation, and quinine in moderate doses may be given daily until the wound has completely united.

In cases where the peritoneum has been opened, I believe it would be good practice to cut down on the abscess, open the peritoneal cavity, and

wash it thoroughly with carbolized water. The operation certainly would not hasten a fatal issue, and the patient would, in such a case, have no chance without it.

ORBITAL CELLULITIS is not a common form of disease. It is usually the result of external violence, involving more or less the eyeball and the neighboring tissues. Not infrequently it follows convalescence from low fevers or erysipelas.

The *symptoms* are obscure at the inception of the disease, consisting simply of deep-seated pain in the orbit, somewhat throbbing in character, with redness and swelling of the conjunctiva and lids. Subsequently the eyeball is pushed out by the exudation behind, and becomes very prominent and, to a great extent, immovable. Fluctuation may be ascertained by lifting the upper lid, and examining the distended conjunctiva.

The *treatment* consists in placing warm fomentations over the eye, applying leeches to the temples, and administering a mild cathartic internally. Most surgeons agree that no attempt should be made to open the abscess until a very distinct pointing takes place near the surface. Then it is well to puncture and clear out the cavity. Tonics and stimulants are indicated in the majority of cases.

MALIGNANT CELLULITIS.

This disease is usually the result of the introduction into the circulation of an animal poison, which excites a violent and destructive inflammatory action in the cellular tissue and skin, and superinduces constitutional disturbances which generally end in death.

There are two varieties of malignant cellulitis: the first arising from the introduction of dead or decomposing material by means of a dissecting wound or a simple abrasion; the second resulting from the insertion of a peculiar virus through a wound made by the teeth or fangs of a reptile, or the sting of an insect.

The persons affected by the *first* form of malignant cellulitis are generally students of medicine, and physicians who make a special study of morbid anatomy in the "dead-house" or dissecting-room. But it is not invariably confined to this class. Many persons acquire the disease from handling dead animals or putrid meats, the decomposing material entering the circulation through an old cut or abrasion of some sort on the fingers or hands. I have seen cases where the entrance of the poison was effected through the presence of an ordinary "hang-nail." Surgeons also may contract the disease during an operation, by handling a gangrenous limb, or unclean and gangrenous ulcers. The persons affected may be unconscious of any injury, or of having at any time been the subject of local poisoning. Within twenty-four hours from the time of puncture with the dissecting-knife or jagged end of a bone, the border of the wound assumes a dusky red hue, and becomes considerably swollen; the epidermis is raised by a brownish serum, which in a few hours becomes opaque and purulent. A sharp, burning pain occupies the seat of the wound, and severe shooting pains extend up the arm to the shoulder. Red lines are seen radiating from the wound up as high as the axilla, indicating the presence of lymphangeitis. The lymphatic glands in the axilla become enlarged and painful. At this time the whole limb is greatly swollen; it is infiltrated throughout by serous lymph and pus, and irregular masses of suppuration form in various parts, including the lymphatic glands. Sloughing of the

integument over these parts soon follows, and through the openings large quantities of fetid pus are discharged.

Lymphangeitis and lymphadenitis are marked features in nearly all forms of malignant cellulitis. The lymphatics as well as the veins carry the poison. The poisonous matter inflames the lining membrane of these channels, and may produce coagulation of their contents. In some cases it is intercepted by the lymph glands, and produces an inflammation which rapidly destroys them.

From the onset of the disease, the constitutional symptoms are well marked and violent. The poisoning of the blood is evidenced by chills and rigors, which are rarely repeated after the first day—the disease in this respect differing from ordinary pyæmia, which is usually attended by chills during the whole course of the affection. The chills are followed by high fever, the temperature rapidly rising to 104° F. or 106° F., or even higher. There is often frontal and lumbar pain, and pain in the limbs also. The eyes are suffused, the expression of the face is one of deep anxiety, and the tongue is dry and coated with a brown fur. Billroth says that the tongue is sometimes as hard as wood. In the worst cases there is delirium. The urine is scanty and high-colored, and contains albumen. The patient sinks into a typhoid condition, is apathetic, and unless possessed of sufficient vitality to overcome the effects of the poison, may succumb to the disease in from three to ten days from its commencement.

Although a large majority of patients afflicted with malignant cellulitis die, there are cases where the local inflammation is the principal element, the lymphatic glands having intercepted most of the poison. In such cases the constitutional as well as the local symptoms are much milder, though the inflammation in the cellular tissue of the diseased limb passes through all the phases previously described, and the patient recovers with the loss of a finger, or perhaps of the hand and forearm as well.

On post-mortem examination, the liver will be found softened and filled with blood. The spleen is very friable and enlarged, and infarcts may be found in it. There are no collections of pus, such as are found in pyæmia.

Treatment.—As soon as the wound is made, it should be washed thoroughly and sucked by the patient. A little nitric acid or pure carbolic acid may then be applied, so as to cover every part of the wound and neighboring integument, and the wounded limb should be suspended in a sling and covered with charcoal poultices. A grain or two of opium and from twenty to thirty grains of quinine should be given as soon as possible after the injury. When the cellulitis is fully developed—that is to say, when the wounded extremity is swollen and painful, and red lines have begun to show on the hand and forearm—a free incision should be made through the wound down to the bone, extending at least half an inch above and below. When suppuration occurs, other incisions also should be made in various parts of the forearm and arm, through the skin and subcutaneous cellular tissue to the muscles, so as to afford exit to the pus and other inflammatory formations, and thus diminish the tension in the swollen limb. The charcoal poultices previously recommended are still to be used, enveloping the limb from the shoulder to the tips of the fingers; the limb is then placed on a pillow, and opium and quinine again administered. If the charcoal cannot be had for the poultices, clay, linseed meal, or bran will be found to answer well as substitutes.

Stimulants may be given *ad libitum.* If the stomach fails to retain them they may be injected, well diluted, into the rectum.

The *second* form of malignant cellulitis arises from wounds or bites of the rattlesnake, cobra di capello, tarantula, scorpion, etc., and other reptiles and

insects. In these cases, the constitutional disturbances are of such magnitude that the cellulitis is of comparatively little consequence. There are cases, however, in which the inflammation in the wounded limb endangers the life of the patient independently of the general blood-poisoning, and in which recovery may take place under judicious treatment. The absorption of the virus and the succeeding local inflammation take place more rapidly than in the preceding variety. Indeed, the marked changes, both local and constitutional, may run their course in two or three hours, terminating the life of the patient. In the milder forms of the disease, the wounded limb is infiltrated rapidly with bloody serum and lymph, and rapidly increases in size. The integument has a mottled and puffy appearance, and blebs of bloody serum form under the epidermis. The inflammation may extend to the tissues of the trunk on the wounded side. If the disease is protracted for three or four days, purulent masses form all through the diseased limb, as in the previously described form of the disease; or gangrene may set in and destroy the life of the patient, after the constitutional effects of the poison have been overcome by the proper antidotes. (See Article on Poisoned Wounds, page 83.) The *treatment* consists in preventing the poison from entering the circulation by means of incisions, the application of ligatures above the wounded part, cupping the wound, cauterization, and hypodermic injections of carbolic acid at various points up and down the limb. Free incisions to lessen the tension in the limb, and the application of charcoal poultices mixed with sweet oil to the whole extremity, are efficient means of lessening the inflammation. Carbonate of ammonium and whiskey may be given internally in large quantities. Ammonia is sometimes introduced hypodermically.

MYXŒDEMA.

MYXŒDEMA, otherwise known as *Hypertrophy of the Cellular Tissue, Cretinoid Disease, Mucoid Degeneration of the Cellular Tissue, Polysarcia*, etc., is a rare affection first described by Sir William Gull, and subsequently by Dr. Ord and M. Olivier. It was at one time supposed to be simply an increase in the adipose tissue, hence the term *polysarcia*. There is a large increase in the fatty elements of the body, but the principal changes are found in the component elements of the cellular tissue.

The characteristic *symptoms* of the disease, as given by Gull, are as follows: " There is general enlargement of the whole body, especially marked on the face, which enlarges transversely, and becomes round. The skin becomes soft and delicate, and acquires a sort of transparency analogous to that of porcelain; the cheeks are rose-colored. The subcutaneous cellular tissue about the orbit becomes loosened, that of the back of the neck, and of the throat, thick and folded. The distance between the eyes seems large, and the root of the nose depressed. The lips, large and thickened, are of a purplish-red color; the alæ of the nose are hypertrophied. The face is modified in its shape, and assumes a bloated appearance, at the same time preserving a soft and rather agreeable look. The tongue becomes large and thick, the voice guttural, and pronunciation is impeded by the deformed tongue. The same changes appear on the hands, and they become infiltrated and massive. As the disease progresses the patient becomes listless, and capable of less and less exertion. The intelligence is dulled, and the habitual indifference is but rarely interrupted by periods of irritation. There is, properly speaking, no mental trouble. The trunk and inferior extremities become loaded with fat, giving the appearance of general œdema."

The disease lasts from ten to fifteen years, and its termination is characte-

rized, according to Dr. Ord, by a remarkable decrease in the animal heat. In one recorded case, the temperature was only 77° F.

Under the microscope, all the elements of the areolar tissue, including the fibres, cells, and " interstitial mucous substance," are very much increased. These changes are not confined to the integument or subcutaneous cellular tissue, but are also found in the arteries and internal organs.

Treatment.—Iodine, iron, and cod-liver oil have been recommended, and tried with little or no benefit. On theoretical grounds I should recommend Russian baths, frequent friction of the surface, electricity, and very active exercise in the open air.

ATROPHY OF THE CELLULAR TISSUE.

Atrophy of the cellular tissue, though sometimes combined with progressive muscular atrophy, generally occurs as an independent disease. In the greater number of cases it arises from the prolonged irritation of a nerve or nerves. It occurs most frequently in the face and lower extremities. Brown-Séquard mentions a case which came under his notice in Boston, where atrophy of one side of the face was preceded by convulsive movements of the muscles on the affected side; the disease was ascribed to irritation of the dental nerves. Atrophy of the cellular tissue on one side of the face has also been caused by irritation of the facial nerve. Schott and Romberg have called this variety of the disease *facial trophoneurosis*. It is as rare as other forms of the affection.

It is probable that the wasting of a limb which has been kept for a length of time on splints, or which has been prevented by disease from doing its work, arises from atrophy of the cellular tissue as well as from atrophy of the muscles and absorption of fat.

Treatment.—If the cause of the disease can be reached, it must be removed if possible; the diseased part should be frequently sprayed with cold water, and rubbed dry, and the induced current applied daily to the nerves until some benefit is obtained. Nux vomica and cod-liver oil are useful as internal remedies.

PARASITES OF THE CELLULAR TISSUE.

The parasites usually found in the subcutaneous cellular tissue are the *Cysticercus cellulosa*, the *Guinea worm*, known also as the *Dracunculus* and *Filaria Medinensis*, and the *Sand flea*, or *Pulex penetrans*.

CYSTICERCUS CELLULOSA.—This parasite is found usually in the cellular tissue between the muscles; less frequently it occupies the meshes of the subcutaneous cellular tisue. It is occasionally seen in the delicate areolar tissue, under the conjunctiva, in the aqueous and vitreous humors, and also in some of the internal organs. It is a species of hydatid, an undeveloped tænia solium. It consists of a small vesicle, about two lines in diameter, in which the embryonic worm is supported. It is not apt to give any particular manifestation of its presence while in the subcutaneous or inter-muscular cellular tissues. Even in the delicate sub-conjunctival layer, it merely excites slight conjunctivitis. It is only when the aqueous and vitreous humors, or some of the internal organs, are invaded, that any danger arises from its presence.

FILARIA MEDINENSIS.—The *Filaria Medinensis*, or common Guinea worm, infests countries south of the equator. Rarely is it seen in temperate climes,

and then only when transported in the tissues of some traveller from the southern regions.

In its undeveloped state the Guinea worm measures $\frac{1}{70}$ of an inch in diameter. At this period of its existence it penetrates the integument through the sudoriparous glands or their follicles, and finds a lodgment in the cellular tissue. Then follows a period of "latent existence" (Busk), varying from six to eighteen months, during which time the parasite gives little or no evidence of its existence. At the end of that period it measures from two to ten feet in length when uncoiled. It now makes an effort to reach the external world, and in doing so excites the circumscribed inflammation in the integument and subcutaneous cellular tissue that indicates its presence. A minute elevation of the skin occurs just over the residence of the parasite. This spot has a reddish color, itches, and when pressed is painful. The swelling soon becomes harder and redder, looking very much like a small boil; pus forms at its highest point, and the head of the worm protrudes. Ulceration sets in around this point, and may extend some distance into the surrounding tissue; and there may also be some deep-seated spots of suppuration.

When the patient has a large number of these worms in various stages of mature development, the local inflammation is accompanied by some pain in the affected extremities and considerable febrile excitement.

The *treatment* consists in cutting down carefully through the inflamed spot, and extracting the parasite with a forceps which grasps the centre of its body. Busk recommends the slow removal of the parasite by winding the body slowly around a piece of pipe-stem, bougie, or twig, bringing out each day a portion until the sac is completely emptied.

PULEX PENETRANS.—The *sand flea*, *jigger*, or *pulex penetrans* is another troublesome parasite peculiar to southern climates. The male is harmless. The female does not attempt to enter the skin until she becomes impregnated. Then she seeks a nidus in the subcutaneous cellular tissue and skin, where the process of incubation can go on without hindrance.

The parasite passes in through the integument under the nails, between the toes, and at other parts of the feet. As soon as the ova distend the abdomen of the flea, a small whitish swelling appears (Busk) which grows rapidly, and excites an inflammation which is apt to lead to the formation of intractable ulcers.

The *treatment* consists in enlarging the opening through which the insect entered, and picking it out with the point of a needle. Afterwards the cavity should be frequently washed with a strong solution of carbolic acid, turpentine, or tobacco juice.

INJURIES AND DISEASES OF BURSÆ.

BY

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THE large number of bursæ found in the human body, the liability of their diseases to be confounded with more serious maladies, and the fact that most, if not all, cases of peri-arthritic suppuration can be traced to a precedent inflammation of one of these sacs, demand a more extended notice of their affections than is usual in most surgical works.

In addition to those usually described by anatomists, adventitious bursæ are apt to be developed wherever projecting portions of the skeleton, but thinly covered by soft parts, are subject to long-continued pressure and friction. These adventitious bursæ usually form over abnormal projections of the skeleton, such as are seen in gibbosities of the spinal column, or on the outer side of the foot in talipes varus, where the structure of the soft tissues is such as is not calculated to bear pressure without injury, unless some elastic water-pad, such as a bursa, is interposed between the integument and the subjacent hard parts. Enlarged bursæ have been mistaken for aneurisms, and many of them communicate with the neighboring joints. On this account, their injury, whether by accident or by the surgeon's knife, has been sometimes followed by destruction of the functions of the limb, or even by loss of the patient's life.

DEVELOPMENT AND ANATOMICAL RELATIONS OF BURSÆ.

A careful study of the mode of development of bursæ, and of their anatomical relations, is of prime importance, and will render clear certain facts in connection with their diseases, otherwise difficult to understand. Anatomists are in the habit of describing two varieties of bursæ—the *bursæ mucosæ* and the *bursæ synoviales*—the latter being ligamentous sheaths lined with a thin secreting membrane, in which the tendons play, while the former are simple serous sacs, which may or may not be in relation with tendons. Vascular fringes are present in certain of the so-called bursæ mucosæ, but there is no real histological difference between the two varieties.

The diseases of the bursæ mucosæ will chiefly occupy our attention, although those of certain sacs which have been classed by some anatomists with the synovial bursæ will be described. Bursæ, from a clinical standpoint, should be again subdivided into two classes, (1) the subcutaneous, and (2) those in relation with the more deeply situated tendons, and, in consequence, often connected with joints. This is not a nice anatomical distinction, but one of practical import, since treatment which would be safe and appropriate to bursæ of the former variety might, and often does, end most disastrously

when applied to those of the latter. This practical point, resulting from the differing anatomical relations of bursæ, must never be lost sight of in deciding what is proper to be done in any given case.

All bursæ are closed serous sacs, which are, as I shall next show, developed from the cellular tissue. This latter consists of innumerable decussating fasciculi of connective tissue, continuous with the skin, periosteum, aponeuroses, etc. From the interweaving of the fasciculi result minute spaces, in which there normally exists a serous or lymph-like fluid. Large flat nucleo-nucleolated cells are seen applied along the fasciculi, which resemble, and are practically identical with, the endothelial cells of all serous membranes. Owing to the mechanical arrangement of the connective-tissue bundles, they move upon one another as do the opposing surfaces of any serous cavity, such as the pleura. These movements are facilitated by the presence of the serous fluid before adverted to. All that is now necessary for the formation of either a normal or abnormal bursa, is a local accumulation of the normally present fluid, which, by pressing aside the connective-tissue bundles, will condense them into a wall lined by a more or less imperfect layer of connective tissue, that is, endothelial cells. Such cavities will be traversed—as bursæ frequently are—by imperfect partitions, or perhaps merely isolated bundles of fibrous tissue. If, as pointed out by Cornil and Ranvier, the site of a hypodermic injection of serum be examined, precisely what I have just described will be seen, neither macroscopically nor microscopically different in any important detail from the appearance presented by a normal bursa. If it be asked what produces the primary accumulation of fluid, I answer, the normal movement of pressure and friction to which the parts are subjected. These produce a local congestion, resulting in the effusion of fluid; the congestion recurring, prevents its absorption; and it finally becomes permanent, and also changed in character. The continued traction on the imperfect partitions and bridles which traverse the cavity, results in their nutritive elongation or rupture, thus either permitting free communication between the different loculi, or throwing a number into one. Whether of intra-uterine—for some appear by the end of the third month—or of extra-uterine origin, I believe that the mechanism is the same for all varieties of bursæ.

When it is borne in mind that the normal interfascicular spaces of the connective tissue are in direct communication with the lymphatic vessels, it is clear that a bursa is nothing but a constant, larger lymph space. As a bursa is, then, an integral part of the connective tissue, there is no warrant that inflammation of one of these sacs will remain localized. On the contrary, a traumatic inflammation of the bursa, over the olecranon, for instance, not uncommonly results in an extensive cellulitis of the arm and forearm. On the other hand, a primary affection of the skin and subcutaneous cellular tissue may excite inflammation in a contiguous bursa. This lymphatic connection—the bursæ being, indeed, as has been seen, a part of the lymphatic system—readily accounts for the marked constitutional disturbance seen in acute inflammation of certain of the larger of these structures. To compare small things with great, the condition is similar to that seen in peritonitis, where, the peritoneal sac being practically nothing but an enormous lymph space, septic products are rapidly absorbed, and, by their sudden introduction into the blood-current, produce the well-known, profound constitutional impression observed in that disease.

These pathological facts should be kept constantly in mind, as they have an important bearing on treatment. The surgeon must also never forget that bursæ which are contiguous to joints, but do not communicate with them in the young, often do so in the adult.

BURSITIS.

CAUSATION; GENERAL CONSIDERATIONS.—Ordinary gout, plumbic gout,[1] syphilis, rheumatism, blood-poisoning, scurvy, and perhaps certain forms of Bright's disease, are undoubted predisposing and, in some cases, exciting causes of this malady. The failure to recognize these underlying conditions accounts for the obstinacy of certain cases under merely local treatment. Wounds, contusions, the recurring pressure and friction incident to certain occupations, excessive muscular exertion, sprains, etc., are among the more common exciting causes. In pronouncedly rheumatic or gouty persons, the most trivial use of parts, or even variations of temperature or errors in diet, will suffice to produce a recurrence, if not a primary attack, of bursitis. Bursal enlargements due to rheumatism or gout appear rapidly, and are apt to attack the deep-seated rather than the superficial bursæ. The effusion may suddenly leave one bursa, and another may become distended; and again this enlargement may disappear, only for the disease to attack a third sac.

ACUTE BURSITIS.—After some traumatism, or perhaps only over-use of a part, a local, tense, more or less distinctly fluctuating swelling will appear, which is tender on pressure, and in certain instances the site of severe lancinating pain. The skin at first presents a circumscribed pink flush. This soon spreads to the adjacent integument, and if the inflammation increases—especially should suppuration occur—the skin becomes œdematous and of a dusky, livid appearance, when ulceration soon occurs. The constitutional reaction is often marked, with high temperature, headache—I have even seen delirium—furred tongue, and confined bowels. The effused fluid, containing floating masses of lymph, consists of serum, which may be of a reddish tinge from a slight admixture of blood. When the bursitis is the result of a blow, the effusion may consist largely of pure blood, which may remain fluid, or, after clotting, may undergo various changes. Acute bursitis terminates by resolution, suppuration, or sloughing. Rheumatism, gout, pyæmia, and plumbism are undoubtedly predisposing and sometimes exciting causes.

Treatment of Acute Bursitis.—When describing the treatment of the diseases of each bursa, any special indications presented by its nature or locality will be adverted to. At present, the general principles involved in the treatment of any acute bursitis will be considered. The prime essential—since, as we shall see, over-exercise frequently gives rise to effusions into the bursæ—is absolute rest of the limb, insured by the recumbent position, and the application of an appropriate splint. The condition of the bowels and digestion should be investigated, since, if a spreading cellulitis result, the vital powers may be taxed to their utmost. If a purgative be indicated, with a vigorous patient, a mild mercurial followed by a saline will be eminently appropriate. If the patient be in a depressed state of health, a mild laxative will suffice. A simple, bland, unirritating diet should be directed, and, if the patient be of a gouty constitution, something even like the old-fashioned antiphlogistic regimen will be not only appropriate, but imperatively demanded. Pain must be controlled by opium, best combined with diaphoretics. Gout or rheumatism, either demonstrated or suspected on good grounds, indicates the exhibition of appropriate remedies, such as salicylic acid, the salicylates, colchicum, alkalies, etc. In vigorous cases, when the inflammation runs high, free leeching is useful. The use of blood-letting should, however, be limited to the most severe forms of acute bursitis, when a spreading cellulitis of the

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[1] Guy's Hosp. Rep., 3d s., vol. xv., 1870, p. 46.

whole extremity is impending, and can only be averted by such local depletion of the bloodvessels as will permit the circulation to go on, and thus prevent strangulation of the tissues. After the cessation of the bleeding, a bladder of pounded ice should be kept constantly applied, or cold evaporating applications, such as a spirit lotion, or lead-water and laudanum; or, in default of anything better, simple cold water may be used. If, in despite of all these measures, suppuration should occur, poultices should be substituted.

When pus has fully formed, it must be evacuated by some means. If the suppurating sac does not communicate with a joint, the knife—best with antiseptic precautions—should be made use of. On the other hand, when there is ground for thinking that the bursa opens into a contiguous joint, a careful aspiration under the spray must be the first resort. If, after repeated tappings, pus reaccumulates and will manifestly discharge itself, the abscess should be boldly laid open, but only under the strictest antiseptic precautions. Where such measures are impossible, owing to want of apparatus, "hyperdistension" with a two per cent. solution of carbolic acid, after Callender's method, should be substituted. It is well to be certain that *pus*, not *serum*, is present, as incisions under the latter circumstances have proved fatal by favoring septic absorption.[1] Incisions into inflamed tissues, as Paget[2] has ably pointed out, should, when possible, be avoided, since they are exceedingly apt, as I have seen myself, to be followed by the development of phlegmonous erysipelas. The surgeon must, however, beware of allowing pus to remain confined in the bursæ contiguous to joints, lest the sac rupture subcutaneously, and the pus set up a diffuse periarthritic suppuration, or lest a similar disaster result simply from the inflammation spreading by contiguity of tissue, for want of a proper vent for the irritating matter. In a doubtful case, the aspirator or an exploring needle will either secure the safe removal of whatever is present, or show that the knife is not needed.

Should the suppuration be excessive, tonics, such as iron, quinia, or bark, ammonia, good food, and stimulants, must be exhibited. Erysipelas, including erysipelatous cellulitis, must be treated as if occurring from any other traumatism, by iron, opium, quinia, etc., and, if necessary, by appropriate incisions. Should sloughing occur, yeast or charcoal poultices should be applied, and when the surface cleans off, the sore, as well as the troublesome sinuses which occasionally result, must be treated on general principles. Sinuses when recent can often be made to heal by appropriate pads or compresses firmly applied. In the event of their failure, when the case becomes chronic, injections of some irritant, sufficiently concentrated to set up a degree of inflammation which will give rise to granulations, such as iodine or carbolic acid, should be tried. An oakum seton may also prove useful. Where no important parts intervene, the sinuses should be laid open with the knife or galvano-cautery. The latter instrument is the better, since the heated wire effectually destroys the indurated walls, so as to demand less care in the after-dressings to insure healing from the bottom.

SUBACUTE BURSITIS.—The first symptom consists in a local tenderness on pressure, which produces a peculiar sense of crepitation beneath the fingers. This is due to a slight serous effusion, and can be detected before any local swelling occurs. In all other respects the symptoms detailed under the head of acute bursitis are present, but in many cases the constitutional and local symptoms are very slightly marked. Subcutaneous rupture sometimes occurs, either spontaneously or from slight force. This results either in a cure or in

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[1] Dupuytren and others have recorded such cases.
[2] Clinical Lectures and Essays, 1st ed., pp. 58–66.

diffuse inflammation of the cellular tissue. In rare instances, the skin also gives way, when, practically, a wound of the bursa results. Subacute bursitis usually terminates either by resolution or by passing into the chronic form, although, when neglected, more acute symptoms may supervene, when any or all of the accidents attendant upon acute bursitis may be observed. The contained fluid resembles that seen in acute bursitis, but the changes are not so marked.

Treatment.—This should embrace, if possible, quiet for the affected part, repeated light blistering, or painting with tincture of iodine—either alone or conjoined with firm pressure by means of compresses[1]—and proper constitutional treatment, should gout, rheumatism, or syphilis be suspected. Compression acts in two ways in producing absorption, viz: (1) Sufficient irritation is set up in the comparatively bloodless cyst-walls, to produce that degree of congestion which is favorable to osmosis, and, the pressure being persisted in after the removal of the fluid, lymph is thrown out which obliterates the cavity; (2) the over-full capillaries of the sac are emptied, so as to admit of absorption by the support afforded on the one side by the compressing body, and on the other by the closely confined elastic fluid. In addition, experiment has proved that pressure upon the fluid which is around the bloodvessels will favor its absorption. I am thus particular in giving these explanations because they render it clear why iodine, blisters, etc.—which simply increase the vascularity of the cyst-walls—fail when used alone, but when supplemented by pressure often succeed. These measures are only likely to prove successful when the bursa is superficial, and manifestly for the reasons just detailed; since in a deep-seated sac no such pressure can be exerted through the superjacent parts as will either increase vascularity or support the bloodvessels, nor can counter-irritants act for similar reasons.

When the amount of fluid is such as to render it probable that only the prolonged use of the above-mentioned remedies will prove effectual, its withdrawal by aspiration, or by a small puncture or valvular incision, with the application of firm compression over the emptied sac, will save much time. When the cyst wall is thickened, such measures will probably prove unsuccessful, and in this event I would recommend the following procedure. After tapping the cyst under the spray, a seton formed of a few strands of prepared catgut should be passed through the bursa, and then a dressing of numerous layers of carbolized gauze should be applied. Unless the patient complains of pain, the dressing should not be removed for a week or ten days, when the ends of the seton will be found lying in it, the wound closed, and the bursa consolidated.[2] Another mode of treatment is to evacuate the fluid by a valvular incision, made with a tenotome which should then be used to scarify the interior of the sac, followed by the application of firm pressure. The ordinary seton, though usually a safe remedy, occasionally gives rise to serious consequences. When it is used, the patency of the lower opening should be carefully insured, so as to provide for efficient drainage. These methods are not applicable to bursæ communicating with joints; their treatment will be considered when we come to speak of the special bursæ.

CHRONIC BURSITIS.—Usually of a chronic form at the outset, this affection may be a sequence of an acute or subacute bursitis, generally the latter. It

[1] Sponge is an excellent means of applying compression. The limb should be first carefully bandaged, and the dried sponges should be then firmly secured over the part by another roller. When all is in position the dressing should be wetted, when the sponges will swell, and exert firm, uniform, and elastic pressure.

[2] Roxborogh, Lancet, vol. xxxviii. p. 193.

is, as might be expected, usually excited by a slight but prolonged or persistently recurring irritation, such as pressure or friction, or both combined. Gout, rheumatism, syphilis, and plumbism play no unimportant role in the causation of chronic bursitis. Without recognizing this fact it will be impossible to cure certain cases. The effused fluid gradually becomes thicker, until it finally resembles synovia. Again, a brownish or greenish sticky fluid is found, containing a variable proportion of chlolestearine. Blood is frequently present, either recent and unchanged, or old and altered, rendering the fluid grumous, or full of a substance like coffee grounds.

So-called "melon-seed" bodies are usually found in varying numbers. They probably arise from three sources. (1) The terminal portions of the vascular fringes which are present in certain of the bursæ become hypertrophied. Their pedicles become elongated and thinned, so that the ordinary movements of the parts rupture them, when they become free. This origin is demonstrated by the appearances presented on microscopic examination, when the spot corresponding to the site of the pedicle is seen to be unprovided with the epithelial covering which is elsewhere present. (2) A second source is from masses of lymph, or clots of blood, which, either torn off from the walls or floating free in the fluid, become moulded by mutual pressure and friction. (3) Rokitansky maintains, from the concentric arrangement of the lamellæ which some present, that they are formed by the successive deposition of layers of lymph from the more fluid portions of the effusion. They usually consist either of pure amorphous fibrine, or of a compact connective-tissue substance, occasionally mixed with cholestearine. In rare instances they may be formed of imperfectly developed cartilage, when, of course, their source is the fringes before mentioned, which sometimes contain cartilage cells.[1] The centres of certain of the larger fibroid bodies are soft, or have actually liquefied, thus giving rise to the idea that they are hydatids, as Dupuytren called them.

It is commonly said that the presence of the melon-seed bodies can be detected by the peculiar crackling produced by their mutual friction when the tumor is handled. This is not an infallible sign, since inflamed serous membranes frequently give rise to a similar sensation upon manipulation, when we know that such bodies are not present. Acting much like foreign bodies, they mechanically excite recurring attacks of inflammation. Although not absolutely incapable of removal by absorption, in the majority of cases they are practically so. It is then clear that their recognition is of importance. Their removal is usually imperatively demanded to insure a permanent cure, while in their absence a different and less severe plan of procedure will often suffice.

Both in subacute and chronic bursitis, an injury may give rise to the sudden effusion of blood, converting the tumor into an hæmatocele. If accompanied by marked ecchymosis of the surrounding parts, this condition may be suspected, but I know no means of positively determining its existence. A blow or any injury frequently gives rise to an acute attack, which may result in sloughing of the thickened bursa. The bursal walls are thickened in differing degrees, usually in proportion to the duration of the disease and the amount of irritation to which the tumor has been subjected. In old neglected cases, where continuous irritation of a low grade has long existed, the sac becomes almost obliterated, and upon section looks not unlike a cured aneurism with its concentric layers of fibrine. One or more central cavities remain, traversed by delicate bands or imperfect membranous septa, producing a reticulated appearance, the cells being filled with either a serous or

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[1] At least Cornil and Ranvier describe such in the synovial fringes of joints, with which the fimbriæ of bursæ are analogous.

gelatinous fluid. Such cases must not be confounded with the solid syphilitic variety of bursitis which will be treated of under its appropriate caption.

The pathology of the non-syphilitic cases is very simple. The effused lymph after a time becomes organized as in chronic inflammations of other serous membranes, thus becoming an integral part of the sac wall. Recurring irritation now sets up inflammation of a low grade, both in the normal sac wall and in the pseudo-membranous lining. This results in the effusion of inflammatory products, not only upon the free surface of the old false membrane, but into its substance. In both situations the effusion becomes organized, thus increasing the thickness of the primary false membrane, and adding a new layer upon its free surface which, on further irritation, will itself inflame, thicken, and lay the foundation for a fresh pseudomembrane. Repetitions of these processes will at last result in almost complete obliteration of the bursal cavity.

Thus it will be seen that the thickened laminated sac wall is, of necessity, only sparsely supplied with bloodvessels, which plainly shows that in such a bloodless condition of parts no absorption of fluid can possibly take place, and that to effect a cure no grade of inflammation will avail, however excited, short of that which will induce suppuration, that is, the formation of a vascular granulation tissue, ultimately causing obliteration of the cavity. Much thickened, solidified tumors are apt, if injured, from their feeble blood supply, especially in persons of syphilitic or broken-down constitution, to become gangrenous and slough out *en masse.* Cognizant of this fact, we should be cautious in attempting to excite a curative degree of inflammation, lest it pass sanative bounds and end in a spreading cellulitis.

Microscopically, the thickened walls consist of fibrillated connective tissue, which in parts is hyaline, having imbedded "the characteristic mother and daughter cells of cartilage."[1] Developed as the cyst-wall originally is, from connective tissue, no surprise need be felt that its inflammatory products should go on to the formation of any one of the connective-tissue class of neoplasms, or undergo characteristic degenerations. Thus calcification, ossification, outgrowths of fibro-cartilage, etc., have been observed.

Treatment.—Where the thickening of the bursal walls is not excessive, the use of the seton, after a preliminary tapping of the cyst and evacuation of the melon-seed bodies, is probably the best plan to pursue. Galvano-puncture has been recommended. Barwell advises that a tenotome should be introduced obliquely under the skin, when the bursal walls should be as freely divided as possible, scarified, and the contents evacuated through the incision. This, followed by pressure, is quite as safe as the seton, and in most cases as effectual.[2]

If the walls are very much thickened, giving the impression of an almost solid growth, they should be carefully dissected out whenever their anatomical relations are not such as to forbid it. The plan pursued by Volkmann offers advantages where, as in certain chronic enlargements of the pre-patellar bursa, the growth encroaches on those aspects of the joint at which the coverings are so thin as seriously to endanger it in the delicate and prolonged dissection requisite. Under the antiseptic spray, he splits the bursa open, excises an elliptical portion of the wall, removes the melon-seed bodies, and with some dull instrument scrapes away the softer portions of the thickened cyst-wall. The cavity is then carefully washed out with a five-per-cent. solution of carbolic acid, and two thick pads of carbolized gauze are firmly

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[1] Trans. of the Path. Society of Philadelphia, vol. v. p. 227, 1874–75.

[2] Such methods are, of course, only applicable when the bursa does not communicate with a joint.

applied on either side of the incision. If the wound should not gape enough to insure proper drainage, two short drainage tubes are to be inserted perpendicularly into the sac. The space between the pads should be filled with a thick compress of gauze, the whole joint then enveloped in a number of layers of the same, and the limb bandaged to a posterior splint. In from three to four days, adhesion of the sac-walls takes place. As a rule, only three or four dressings are necessary, cicatrization being completed in from two to three weeks. There was slight suppuration in one only of Volkmann's seven cases.

Volkmann has tried this mode of treatment even in acute phlegmonous bursitis with extensive suppuration around the joint, and reports that such cases do quite as well as simple ones. He has also by this plan successfully cured acutely suppurating bursæ. I am convinced that such bursæ should never be packed with lint. Any of the plans mentioned are preferable to this rude procedure, even if the bursa be not inflamed.

HYGROMA.

Many surgeons indiscriminately apply this term not only to mere hyper-secretion due to irritation, but also to cases of very mild subacute or chronic bursitis, with but little thickening of the sac. It should, however, be restricted to cases of hyper-secretion into bursæ, where, by pressure and friction, congestion is induced which relieves itself by effusion, and, the irritation recurring, a degree of congestion is maintained which prevents absorption of the fluid. The *treatment* by simple rest and removal of the cause will often suffice, but if it does not, blisters followed by pressure, with a precedent aspiration where the fluid is present in large quantity, should be tried.

CONTUSIONS OF BURSÆ.

The subcutaneous bursæ, when contused, frequently become filled with blood, which is usually painlessly effused. Rest, cold evaporating lotions, etc., usually promptly determine the absorption of the blood. It may, however, persist, when the tumor slowly increases, and, if neglected, may in the course of years attain to a huge size. Either with or without effusion of blood, contusions commonly give rise to acute or subacute bursitis. Again, a slight blow may be the origin of a chronic bursitis. Contusions of the deep-seated bursæ are of graver import, owing to the injury of the superjacent tissues, upon which, of necessity, much of the force must be expended, and also to the confinement of the products of inflammation by the overlying tissues, so that, when the injured sac is in relation with a joint, serious sequelæ are not uncommon. The *treatment* must be conducted on general principles, and has been sufficiently indicated when speaking of acute bursitis.

WOUNDS OF BURSÆ.

INCISED AND PUNCTURED WOUNDS OF BURSÆ.—These usually terminate in suppuration with obliteration of the bursal cavity. Under favorable circumstances, it is possible that they may heal immediately, as similar injuries of joints occasionally do. Wounds of the superficial bursæ usually are of but little consequence. Rest, efficient drainage, an antiseptic dressing when possible, or, indeed, any dressing suitable to a similar wound which opens the

cellular tissue elsewhere, will be all that is usually necessary. Should acute inflammation or phlegmonous erysipelas supervene, cold evaporating lotions, irrigations with weak carbolized water, poultices, or the bran box—which gives equable support and compression, while at the same time it absorbs the discharges—are indicated, with such incisions as will insure free drainage.[1] The remarks just made about contusions followed by suppuration of the deep-seated bursæ, are equally applicable to a similar condition the result of a wound. If, as is not uncommon, the injured bursa communicates with a joint, we practically have to deal with a wounded articulation. In a wound of a deep-seated bursa near a joint, the diagnosis between a simple bursal wound and one of the articulation will require care, since in both there will be an escape of synovia. If the wound cannot be explored by the finger, our only guides are the direction and depth of the wound, and the knowledge that there is a bursa normally present in its track. Deciding that only the bursa is involved, the next important point to determine is whether it communicates or not with the articulation. This can only be determined by an accurate knowledge of the normal anatomy of the part, combined with a recognition of the fact that, the older the patient, the greater is the likelihood of the bursa opening into the joint. I would most earnestly insist that, in any event, it is better to err on the side of prudence and treat the case as if dealing with an injured articulation, since a deep-seated peri-arthritic suppuration often ends in intra-articular trouble.

Treatment.—Perfect rest, restricted diet at first, efficient drainage, antiseptic dressings, cold, irrigation—in fact, anything and everything calculated to favor rapid healing—should be resorted to. Later in the case, if pus forms, free incisions, with sustaining remedies and appropriate diet, must be prescribed.

LACERATED AND CONTUSED WOUNDS OF BURSÆ.—These usually involve the more superficially seated sacs, and often give rise to the most acute and complicated forms of bursitis. Thus, very commonly, a contused wound over the olecranon, opening the bursa, results in a cellulitis which involves, perhaps, the whole upper extremity, including the axilla, and is accompanied with great pain and marked constitutional disturbance, which in old or elderly patients may prove fatal. Of course, there are all grades of the disease, from that just described to a simple local inflammation. One peculiarity of all wounds and injuries of bursæ is, that they are slow at first to take on inflammatory action. All cases do not exhibit this peculiarity, but in most a distinct interval of from twelve to thirty-six hours—perhaps of forty-eight hours—elapses, when a most acute inflammation rapidly arises.

Treatment.—The treatment is the same that has been already laid down for contusions and incised or punctured wounds of bursæ.

TUMORS OF BURSÆ.

Tumors of bursæ are rare. Mr. Erichsen says that he has met with three or four cases where malignant growths have rapidly appeared in the cicatrices left after the removal of bursal tumors, but justly hints that these may only have been due to the localization of cancer, by the irritation of a previous operation in a patient predisposed to this disease.[2] Simon has also reported[3] a case of fibro-cartilaginous tumor, which sprang from the bottom of a pre-patel-

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[1] See also page 693, for general treatment of acute bursitis.
[2] Med. Times and Gazette, vol. xv. 1857, pp. 476 et seq.
[3] Transactions of London Path. Society, vol. i. p. 153.

lar bursa, laid open in consequence of a sinus of two years' duration, the result of a puncture tried as a means of cure. It consisted of large cartilage cells imbedded in a dense fibrous matrix. After removal the patient did well, and no recurrence ensued. Chronically inflamed bursæ, with much thickened walls, are of course liable to the degenerative changes to which all lowly-organized connective tissue is obnoxious. I· say connective tissue, for, as I have already shown by a reported case, the inflammatory products are developed into this, with a few scattered cartilage cells. Hamilton says that such bursæ may become calcareous, cretaceous, cartilaginous, or bone-like.[1] Indeed, traces of this latter change have been demonstrated by the microscope,[2] and a mass of supposed bone has been removed from the post-olecranal bursa.[3] There is no reason, *a priori*, why any of the connective tissue growths should not occur in bursæ, such as myxomata, enchondromata, osteomata, lipomata, etc. As the "lipoma arborescens" has been found as a tumor arising from the fringes of tendinous sheaths, and as certain bursæ contain analogous adipose folds, it is not unlikely that similar growths of bursæ may yet be reported.[4]

The fibrous tumors which are solid from the outset, as are certain of those in front of the patella, being probably only one of the later manifestations of syphilis, will be considered when describing syphilitic affections of bursæ.

After sloughing of a bursa, fungous outgrowths are not uncommon. Papillomata of an epithelial character have also been reported.[5]

Syphilitic Affections of Bursæ.

The syphilitic affections of the bursæ have only of late years received anything more than the most cursory attention. The writings of the first authors who recognized the fact that venereal diseases attacked the various synovial membranes, do not enable us to determine whether the cases recorded were really syphilitic or merely gonorrhœal, owing to their simply using the term venereal, but not distinguishing between the two affections. Fabre, Swediaur, Hunter, and Babington were the earliest writers who referred to the fact that certain diseases of the joints occurred in secondary and tertiary syphilis, and, as I shall show presently, these at times coincide with affections of the neighboring bursæ. Dupuytren and Bonnet both recognized syphilis as a cause of joint disease. Crocq[6] also met with a few cases. Richet, Cullerier, Follin, Verneuil, Lancereaux, and· A. Fournier have published observations to a similar effect. Ricord denies that syphilis does more than influence the course of arthropathies. After a study of the phenomena offered by syphilitic disease of the articular synovial membranes, Verneuil[7] first described the effects of secondary syphilis on the sheaths of the extensors of the fingers. Five years after,[8] he pointed out that, in tertiary syphilis, various subcutaneous and tendinous bursæ were the site of gummata. A. Fournier[9] has confirmed in the most satisfactory way these statements of M. Verneuil. R. W. Taylor[10] and E. L. Keyes[11] have also published series of illustrative cases. Scattered through

[1] Principles and Practice of Surgery, 1872, p. 469.
[2] Pritchett, Trans. Lond. Path. Soc., vol. ii. p. 137.
[3] J. Heily, Australian Med. Journal, 1868, vol. xiii. pp. 113–115.
[4] Billroth, Surgical Pathology, pp. 498, 499.
[5] Dollinger, Archiv f. klin. Chir., Bd. xxii. S. 697, 1878.
[6] Traité des Tumeurs Blanches, etc., 1853.
[7] Gaz. Hebd. de Médecine et de Chirurgie, 1868.　　　　[8] Loc. cit., 1873.
[9] Note sur les Lésions des Gaines Tendineuses dans la Syphilis Secondaire. (Gaz. Hebd. de Méd. et de Chirurg., 1868.)
[10] American Journal of Med. Sciences, 1876.
[11] American Journal of Syphilography, etc., April, 1871 ; Archives of Dermatology, Jan. 1877, p. 169.

the various text-books and journals a few cases can be found, which will be spoken of in their appropriate places.[1]

SYPHILITIC BURSITIS.—Syphilitic bursitis attacks the tendinous bursæ more frequently in women, in contradistinction to *gonorrhœal* bursitis, which affects more often the opposite sex. The subcutaneous bursæ, however, seem to be equally affected in both sexes, although as traumatisms sometimes act as exciting causes, this equality may be more apparent than real, since men are more exposed to such accidents than women.[2] The tendinous bursæ most commonly attacked are those of the sartorius, semi-membranosus, biceps cruralis, and biceps brachialis. Of the subcutaneous bursæ, the pre-patellar, and that over the olecranon, are the most often diseased. Usually there is a pre-existing gouty or rheumatic taint.[3]

The gravity of the affection is, as in the other phases of syphilis, in direct proportion to its stage of development. Thus, the further advanced syphilis is, the more profound will be the pathological changes detected. During the secondary period these will be superficial, amounting merely to a chronic, or, more rarely, subacute congestion of the serous and subserous tissues, accompanied or not by a serous effusion. The latter occurs habitually in the chronic form, and presents nothing different from that seen in chronic bursitis. When the effusion is slight, crepitation may be elicited by pressure. Tertiary syphilitic bursitis seems to be confined to but a small number of bursæ, viz., the sub-quadricipital, the pre-tibial, pre-patellar, those of the patte d'oie, the sub-tricipital, and a few others.

Here the sac walls are thickened and lined with false membrane. In certain cases a fibroid induration occurs, the bursal enlargement starting as a hard, slowly growing, painless nodule. At times there is a genuine gummatous degeneration of the walls, resulting in a complete effacement of the sac-cavity. Both in this condition and in that just described, where inflammation, either spontaneous or traumatic, arises, sloughing *en masse* often occurs. Gummata, if not removed by specific treatment, pass through the ordinary stages of formation, softening, and ulceration.

Reasoning by analogy—since such appearances have been observed in the joints, and since sensations which would indicate similar conditions have been felt in diseased bursæ—the gummatous stage may not be reached, but ovoid, indurated, elastic patches, situated in the serous, or in the subserous and adjacent fibrous tissues, may be developed. M. Verneuil and others have described cases of a fungous hypertrophy, before referred to, affecting such bursæ as those of the inner ham-string tendons, which in these cases are enveloped in a mass of granulations. The walls of the sac may be destroyed, and even neighboring joints may be opened into. This form of bursal enlargement can only be diagnosed by noting that the fluid removed by tapping is bloody, and filled with floating particles.

Subacute Form.—This is an excessively rare affection sometimes met with at the outset of the secondary period. There may or may not be general symptoms. A slight tumefaction exists, with reddening of the skin, if the bursa be superficial. The pain is usually marked, and at times may be violent, and it is provoked by pressure or movement. There is more or less interference with the movement of the part. There is but little effusion, and crepitation can be felt when the tendon plays over the bursa. The dura-

[1] For much of the information contained in this section, see Chouet, De la Syphilis dans les Bourses Séreuses, etc. Paris, 1874; and L. Moreau, Des Affections Syphilitiques Tertiaires des Bourses Séreuses. Paris, 1873.

[2] Chouet, op. cit., pp. 7, 8.   [3] Mauriac, Edin. Med. Journal, vol. xxi. pp. 275, 448.

tion of the disease is usually from seven to eight days, but recurrences are common, and it may eventuate in the chronic form.

Chronic Form.—This is much more common than the former, and is peculiar to the secondary period. Its course is markedly slow, and symmetry of the lesions is common. The local symptoms are the same as in any other chronic bursal enlargement, except that melon-seed bodies have never as yet been observed. The duration of the disease is from seven to ten months. The effusion will decrease to again return without assignable cause. M. Fournier has pointed out that an abortive form is occasionally seen ; an attentive examination of such cases shows, he says, (1) That the pain has a definite site, peculiar, and very circumscribed. (2) That this site corresponds to the course of a tendon. (3) That pressure at this point gives rise to a more or less acute pain. (4) That the pain manifests itself during either active or passive movements.

Diagnosis.—Syphilitic bursal diseases occur most frequently during the tertiary period, and although occasionally seen during secondary syphilis, their recognition must depend on a careful consideration of the various diagnostic points—of which I give the following abstract, condensed from Fournier— since often no incontestable sign of syphilis can be detected.

(1) The history of a primary lesion.
(2) The comparative frequency with which such diseases occur in syphilitics, especially in women.
(3) The association of bursal troubles with other secondary manifestations, or with gummata in the tertiary period.
(4) Symmetry of the lesions, although this is not at all absolute.
(5) The presence perhaps of undoubted syphilitic lesions elsewhere.
(6) The development of the disease contemporaneously with other lesions, and subject to the general evolution of the diathesis.
(7) The absence of any other assignable cause.
(8) The failure of ordinary measures, and the prompt response to specific treatment.

The onset of these affections is insidious, and they pursue a chronic course. The symptoms often intermit, above all the pain and the effusion, when this exists. There are also distinct nocturnal exacerbations of the pain.

Treatment.—To a general course of antisyphilitic remedies, local treatment, such as compression and the use of blisters, should be added. By such means the disease is readily relieved.

GUMMATA OF BURSÆ.—Chouet reports a case where such a condition existed in the sheaths of the peroneal muscles, and coexisted with a marked serous effusion (*hydropisie*) of the common extensors. Gummata occur much more frequently than the forms of syphilitic bursitis already adverted to. They present no symptoms which are peculiar, pursuing the course of other gummata, with the three stages of formation, softening, and, unless prevented by treatment, ulceration. Their general characteristics are distinct circumscription, slow growth, slight sensibility to pressure ; no spontaneous pain, except in rare instances, and then only when irritated ; and, late in the disease, close adhesion to the subjacent bone, etc., and to the superimposed skin, which is of a dull red, coppery, or violaceous color ; the glands do not become engorged.

Diagnosis.—This, in the clearest cases, is dependent upon the satisfactory recognition of symptoms drawn from three different sources, viz., a syphilitic history ; the intrinsic characters of the disease ; and the effect of specific treatment.

(1) Of course the proof of its nature afforded by microscopic examination of the disease is wanting. In all cases thus far reported, there has been either a distinct history of a previous primary sore, or one of various more or less

indubitable secondary and tertiary manifestations. The primary sore has always been acquired some, even many, years before.

(2) The site and form of the tumor usually correspond to those of a normal bursa, or of one normal to the occupation or peculiarity of the individual. The volume of the tumor is never great, not exceeding that of a hen's egg. The swelling most commonly arises spontaneously, or at most has for its exciting cause a slight pressure or injury. It is indolent and almost non-sensitive. In consistence it is firm, elastic, and equally removed from the soft fluctuation of a hygroma and from the hardness of a periostitis, exostosis, or chondroma. The tumor adheres to the skin and subjacent bone. The integument may be unchanged, but is more usually of a red, brown, or violaceous color, and frequently ulcerated. When this latter condition exists, the ulcer has sharp-cut, precipitous sides, the base is grayish, and the discharge sanious; in fact, it resembles in all respects an ulcerated gumma. At times actual fungosities arise, and protrude through the ulcerated opening. The bone is not denuded or thickened, although at first sight it may so appear. The slow growth and chronic duration of the disease are also significant.

(3) Any ordinary method of treatment applied to gummatous cases, however successful it may have proved in simple ones, meets only with failure. In marked contrast to this is the rapid, sure, and easy cure effected by mercurial inunctions or other applications, conjoined with iodide of potassium given internally. These prove efficient even in the absence of rest, so important an element in the successful treatment of simple enlargements of the bursæ.[1]

With such an aggregate of symptoms, I hardly think a careful observer could confound a syphilitic with a simple inflammation of a bursa. However, to obviate all chance of mistake, it may be repeated that a non-syphilitically inflamed bursa, although identical as to site, form, and bulk, is but rarely adherent to the surrounding parts, and never to the bone. The onset of the disease is rapid, the skin is bright red, the heat is more marked, the sensibility is often intense, fluctuation is frequently manifest, and specific treatment is of no avail.

A gumma might possibly be mistaken for a *cold abscess*, which it resembles in its slow course, slight local symptoms, discoloration of the skin, and, when ulceration has taken place, occasional protrusion of fungosities. The antecedent history and conditions, in the case of cold abscess, are those of rheumatism or scrofula, and the onset often coincides with convalescence from certain maladies. The borders of the ulcer are more ragged than clean and perpendicularly cut. Besides, cod-liver oil, tonics, etc., serve a good purpose, while anti-syphilitic treatment proves of no avail.

Syphilitic *periostitis* and *osteitis* are amenable to antisyphilitic remedies, but they are accompanied by acute pain, have not the elastic resistance of a gumma, indeed quite the reverse, and correspond neither in seat nor in form to an enlarged bursa. Finally, should ulceration occur, the probe will readily detect denuded bone. *Bloody effusions* into the bursæ might be confounded with gummata, but the former very often exhibit even at the outset a peripheral ecchymosis, and a certain crepitation on palpation due to the mutual friction of the blood-clots. The fungous form of an ulcerating gumma, when affecting a bursa of the foot, probably forms one of the varieties of perforating ulcer.[2]

Treatment.—This should be of the "mixed" kind internally, with local mercurial inunction. If sloughing occurs, local stimulants, black or yellow wash, calomel ointment, etc., should be used.

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[1] For much valuable information, as well as for the arguments which demonstrate such affections to be really gummatous, see L. Moreau, Des Affections Syphilitiques Tertiaires des Bourses Séreuses. Paris, 1873.

[2] L. Moreau, op. cit., p. 24.

SYNOVIAL HERNIÆ.

Owing to the course pursued by the ligamentous fibres forming the capsules of certain articulations, the synovial membrane at various points receives but indifferent support. This condition is most marked in the wrist and knee-joints. In both there are portions of the capsules, where either from the passage of bloodvessels, or from the angles at which the fibrous bands cross one another, small areas are left almost if not entirely void of ligamentous support. In both, moreover, the surrounding tissues do not afford that even, continuous, elastic support which is given by the muscles to such articulations as the shoulder and hip. What may be termed the popliteal segment of the knee-joint capsule, is unsupported by anything but the loose cellulo-adipose tissue there found. Although both the anterior and posterior portions of the radio-carpal joint are most efficiently supported where the tendons pass over it, the spaces between them can readily yield to a force from within the articulation. An anatomical variation, which, if present, would strongly predispose to synovial hernia of the knee-joint, has been recently reported, viz., an entire absence of the posterior segment of the capsule, the so-called ligament of Winslow.[1] Certain portions of other joints present favoring conditions for synovial herniæ, although thus far, those of the knee and wrist-joint have alone been accurately noted. Either a chronic inflammation of the joint with effusion is the sole cause of these pouchings, or, in addition, a wrench or sprain acts as a determining cause. The joint disease usually consists in osteo-arthritic changes, which are undoubtedly the chief factors, but the importance of the anatomical facts just cited as predisposing causes, seems to have been entirely overlooked.

These herniæ interest the surgeon chiefly on account of their liability to be mistaken for aneurism, and the risk of confounding them with bursæ normally present, but which do not communicate with the joint with which they are in relation. Chassaignac first called attention, at least in the case of the wrist-joint, to the liability of such herniæ being mistaken for aneurism, and clearly pointed out how the error could be avoided.[2]

In his first case, there was over the swelling a scar produced by a fragment of glass, which had been driven in at this point some years previously. There was an ovoid, pulsating swelling situated over the radio-carpal joint. The pulsation, which was remarkable for its energy and the extent of surface involved, seemed expansive, and did not simply elevate the applied fingers. Examined with the member in its habitual position, it was impossible to avoid the error of considering the swelling an aneurism. Forcible flexion of the wrist at once checked the pulsation. This effect was produced, either by relaxing the tension of the artery stretched over the cyst, or, as in another case reported by the same surgeon, by displacing the vessel, which could be felt pulsating to one side of the swelling.

Diagnosis.—The diagnosis of bursal hernia from aneurism is indicated in the preceding sentences, at least as far as the wrist is concerned. In addition, compression of the artery above the tumor would not produce any subsidence of the swelling, nor in most cases would the pulsation be of an expansile character. Although, from pressure, both bruit and thrill might be present, their characters would probably differ from those of a true aneurism in being detected chiefly over a limited, linear portion of the tumor.[3] The diagnosis between

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[1] F. J. Sheppard, Annals of Anatomy and Surgery, Sept. 1881, pp. 110, 111.

[2] Soc. de Chirurgie, Séance d'Avril, 1845 ; also Gazette des Hôpitaux, 29 Avril, 1845.

[3] Since writing the above I see that Barwell, in the second edition of his work on Diseases of the Joints, has reported a case, on p. 507, which confirms the opinion expressed in the text, at least with regard to linear pulsation.

these herniæ and the normal bursæ of the part is often difficult. Usually old joint trouble will be detected, and in certain cases, by appropriate position and manipulation, the contents of the sac can be forced back into the joint, which becomes distended to again relax when the hernia refills. This symptom, when detected with certainty, is invaluable, but the tumor may communicate with the joint, although it cannot be emptied by pressure, since the opening may be valvular.[1] The sudden appearance of one or more circumscribed painful tumors around the circumference of an articulation, after a sprain of a joint which is the subject of chronic inflammatory changes, would clearly indicate what has occurred.

Treatment.—If rest on a splint, with counter-irritation, pressure, and inunction of iodine ointment, do not succeed, the case had best be left to nature. At most, a careful aspiration might be practised; but all more energetic operative treatment should be avoided, owing to the risk, nay certainty, of the joint becoming secondarily more or less involved.[2]

AFFECTIONS OF SPECIAL BURSÆ.

No special therapeutic directions will be given under this heading, except when the relations of the particular bursa under consideration demand a departure from the plan of treatment recommended for the different varieties of bursitis. Thus, the use of the seton, incision, or excision may be mentioned as indicated in a given case, while the exact method of carrying out the treatment cannot be repeated in each instance; so that the reader is referred to the sections on acute, subacute, and chronic bursitis for the more elaborate consideration of the modes of dealing with these conditions. All bursæ which have been described, whether normal or accidental, will be mentioned; but only those, the enlargements of which are liable to be mistaken for other diseases, or which are affected so commonly as to require special consideration, will be treated of *in extenso.*

BURSÆ OF THE HEAD AND NECK.

A bursa is found in the orbit, lining the pulley of the tendon of the superior oblique muscle of the eye. I have been able to find but one case of its enlargement, reported by Aston Key; but, as he details none of the symptoms, I am unable to give any diagnostic points. It was cured by puncture with a cataract needle. There is a bursa situated over the external occipital protuberance; another over the external face of the temporo-maxillary joint; one behind the angle of the inferior maxillary bone; one at the inferior border of the symphysis menti; and one behind the zygomaticus major and duct of Steno, passing beneath the anterior border of the masseter muscle, where it comes into relation with another bursa placed close to the coronoid process of the lower jaw. These two bursæ often communicate, and under such circumstances extend to the base of the cranium. The internal boundary of these twin bursæ is the buccinator muscle, to which they adhere.[3] Certain rare cysts of the cheek, which may extend to the base of the cranium, probably arise from an enlargement of these bursæ.

A bursa surrounds the tendon of the digastric muscle just above the body

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[1] Bryant, Manual of Surgery, 3d Amer. edit., p. 767.
[2] W. M. Baker, St. Bartholomew's Hospital Reports, 1877.
[3] Verneuil, Bull. de la Soc. Anat., 1857, t. xxvi. p. 153

of the hyoid bone; another exists between the middle tendon of the omo-
hyoid and the under surface of the sterno-mastoid muscles; another over the
angle of the thyroid cartilage (pre-thyroid); and another between the layers
of the middle thyro-hyoid ligament, or between the ligament and the adjacent
surface of the hyoid bone (infra-thyroid)—this bursa may be double. Bursal
spaces may be found anywhere from above, and even behind, the hyoid bone,
to the cricoid cartilage, and are usually strictly median; but they are some-
times double, and, under such circumstances, are placed close on either side
of the median line, or even several lines from it. Another bursa exists be-
tween the genio-glossi muscles (supra-thyroid), an accidental one[1] between the
greater cornu of the thyroid cartilage and the inferior constrictor of the pharynx,
and a large one between the trachea and aorta, usually extending from the
origin of the innominate artery to that of the left carotid, and reaching from
the upper border of the aortic arch to the bifurcation of the trachea. Some-
times a second one is placed posteriorly to this bursa, or a small one is found
between the left carotid and the trachea, while the usual large one is located
more to the right. Calori[2] calls these bursæ aortico-tracheal, and says that he
found one or all present in thirteen out of forty dissections. When, as is some-
times the case, the pericardium is prolonged upwards and to the left behind
the aortic arch, the aortico-tracheal bursa is small. Calori also figures a second
bursa, more commonly found than the former, placed beneath the isthmus of
the thyroid gland, to the upper margin of which it sometimes extends; this
he calls thyro-tracheal. It is usually single, but if the thyroid isthmus be
incomplete, there may be two bursæ, placed one on each side of the median
line. This bursa is most commonly present when the pyramid of the thyroid
is well developed, and especially if it is attached to the hyoid bone. When the
musculus throideus of Soemmering—the elevator of the thyroid gland of G.
F. Meckel—is present, a small bursa may be interposed between it and the
thyroid cartilage. Calori figures one such in a case of goitre. This author also
describes two small bursæ, placed one on each side between the crico-thyroid
muscles and the lateral thyroid lobes, which he calls crico-thyro-thyroidean.
They sometimes extend forwards so as to be partially interposed between the
trachea and the thyroid gland. They are sometimes multiple, Calori having
found in one case three sacs to the right and two to the left of the median
line. A bursa is commonly found over the vertebra prominens.

ANTE-THYROID BURSÆ.—According to Hamilton,[3] all varieties of bursal
tumor which occur in the laryngeal region are more common in females than
in males. Elsberg's dissections,[4] however, have shown that the bursæ them-
selves are of more frequent occurrence in male subjects. He explains the
apparent preponderance of diseases of these bursæ in females by stating that
women often consult a surgeon for the removal of such tumors for the cos-
metic effect, to which men are generally indifferent. The bulk of these ante-
thyroid hygromas varies from that of a hen's egg to that of a small orange.
They are subcutaneous, smooth, thin-walled, and elastic, are firmly attached to
the larynx, and usually contain a thin yellowish serum. Almost invariably
situated exactly in the median line, their site varies from a point just above
the thyroid to one over the cricoid cartilage. They may temporarily disap-
pear, to again recur, or, in very rare instances, the tumor may never refill.
An occasional termination, as with the other two varieties, is spontaneous
rupture into the larynx. These tumors are always of slow growth, and their

[1] W. Gruber, Archiv f. Anat. Physiol. u. wissensch. Med. Leipsig, 1875, S. 590.
[2] Mem. della Accad. di Bologna, seria terza, tom. v. 1874, p. 335.
[3] Med. Record, Feb. 1, 1875, p. 545. Hamilton calls them Super-laryngeal tumors.   [4] Ibid.

causation is obscure. I have seen subacute inflammation induced in this bursa by a fall upon the buttocks, through the backward impulse of the trunk producing forcible extension of the head.

INFRA-HYOID BURSA (*Sub-hyoid* or *Thyro-hyoid Hygroma*, *Sub-hyoidean Ranula*).—Except for their higher and somewhat less superficial position, and their occasional interference with respiration and deglutition, the history and symptoms of tumors of this sac closely correspond to those of the ante-thyroid bursa.

Diagnosis of Ante-thyroid and Infra-hyoid Bursal Tumors.—As both these bursae move in respiration and deglutition, there is some risk of confounding their tumors with cysts of the thyroid gland. Their history, the evidently healthy condition of the gland, and the bloody, grumous character of the fluid evacuated by the exploring needle, render the diagnosis clear. The decision as to which of the two bursae is involved is of no practical moment.

Treatment.—Injection with tincture of iodine, after tapping, is probably the safest and best mode of treatment. Incision, with subsequent packing with lint, will effect a prompt and safe cure.[1] Excision is in many cases difficult, dangerous, and sometimes impossible to complete. This operation is quite often followed by troublesome fistulæ, which are hard to cure. J. H. Pooley[2] has suggested that certain congenital median fistulæ may arise from ante-natal disease of these bursae. These median fistulæ are in marked contradistinction to those defects of development resembling "gills" (*branchial fistulæ*), which are always lateral.[3]

SUPRA-THYROID BURSA.—The only case of tumor involving this bursa which I have been able to find recorded, is one reported by C. Wagner,[4] which presented the following symptoms: A chronic, slowly enlarging swelling, of the size of a walnut, was felt over the thyro-hyoid space. The sensations imparted to the finger were those of a fibro-cystic growth. Some hoarseness and slight cough were complained of. By means of the laryngoscope a large tumor, situated to the left side of the base of the tongue, was readily detected; it pushed the left ventricular band beyond the median line. The swelling was twice incised in the throat, giving vent to a quantity of glairy bursal fluid, but rapidly refilled. After three injections of a weak iodine solution, a complete cure was effected. I myself saw a patient, some ten years ago, who presented all the above symptoms, with difficulty of deglutition, respiration, and articulation; but, unfortunately, I have no notes of the case.[5] Marked enlargements of this sac would interfere with deglutition, respiration, and speech, more than those of any other of the thyroid bursae.

Treatment.—After preliminary tapping, a solution of iodine should be injected into the sac. With the aid of the laryngoscope this can be readily done by means of a small syringe, provided with a hollow platinum needle, the point of which should be passed through the pharyngeal wall of the tumor. Should this induce suppuration, an incision must be made at the same place. Œdema glottidis must be carefully watched for if the inflammation runs high, and on its appearance should be promptly treated.

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[1] See section on General Treatment, for risks, disadvantages, etc.
[2] Medical Record, loc. cit.   [3] Peaslee, Ibid.
[4] Ohio Med. and Surg. Jour., 1877, ii. p. 328.
[5] In both these cases I merely infer from the situation of the tumor that this bursa was involved, since if the infra-hyoid sac had been enlarged, it would probably rather have advanced outwardly instead of towards the larynx, while the natural position of the supra-thyroid bursa would almost necessitate the latter course.

Bursa over Vertebra Prominens.—This bursa is quite large. Inflammation, accompanied by a good deal of pain, may be set up by the pressure of a heavy overcoat or other clothing. The diagnosis must depend on the situation of the affection, the tenderness of the part, and the characteristic signs of bursal swelling so often adverted to.

Treatment.—Lead-water and laudanum applications should be made use of at night, while during the day all pressure of the clothing should be removed. To fulfil this indication, Agnew[1] has successfully employed a circular pad stuffed with cotton, and kept in place by being stitched to the clothing. Although I am unaware of any case demanding more radical measures, should such occur, those remedies should be employed which were described in the general remarks upon the treatment of diseased bursæ.[2]

BURSÆ OF THE TRUNK.

These are infrequent, and are more apt to be adventitious than normal. They are found in the lumbar region, and upon the sides of the vertebral column, in those who carry burdens; over the sternum in cabinet-makers, from the pressure of the brace; over the xiphoid cartilage (*bursa hyper-xiphoides*[3]) in rachitic children; over the anterior superior spine of the ilium; and over the coccyx. A synovial hernia communicating with one of the sterno-chondral joints in an infant, has been reported. Bursæ are also found over gibbosities of the spinal column. A bursa has been found over the tuberosity of the first rib, between it and the dorsal muscles. Duval[4] reports a bursa beneath the pubic attachment of the rectus abdominis. This sac is liable to become inflamed at the close of attacks of croupous pneumonia, when pain, which is exasperated by any movement which calls into play the rectus abdominis, is felt at the pubic origin of the muscle.

BURSÆ OF SHOULDER AND VICINITY.

A bursal sac is commonly found over the acromion process of the scapula, in timber-carriers, and another beneath the acromion, between this process and the coraco-acromial ligament on the one hand, and the capsule on the other—the *sub-acromial*. This is the largest bursa related to the shoulder, and in elderly persons it often communicates with the interior of the joint by a large opening. Another large bursa is placed between the subscapular muscle and the neck of the scapula and contiguous portion of the shoulder-joint capsule, into which it often opens; more commonly a second, smaller one occurs, situated more externally, between the subscapular tendon and the capsule of the joint, with which, when present, it almost invariably communicates. A generally, although not invariably, constant bursa is placed between the tip of the coracoid process and the capsule; one or more bursæ have been reported above this process (*supra-coracoid*); another elongated one is sometimes found between the united tendons of the coraco-brachial and short head of the biceps on the one hand, and the capsule on the other; one over the front of the clavicle (accidental); one over the root of the scapular spine, beneath the trapezius; an occasional one, which opens into the joint, placed between the infra-spinatus muscle and the capsule; one between the insertion of the tendon

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[1] Principles and Practice of Surgery, vol. ii. p. 840.   [2] Vide supra.
[3] Jacobi, Am. Jour. Obst., 1875, vol. viii. p. 165.
[4] Gaz. des Hôpitaux, Mai, 1854, p. 250.

of the teres major and the humerus, extending also between this tendon and that of the latissimus dorsi; another between the latissimus dorsi tendon and the humerus; one between the biceps tendon and the humerus; one between the latissimus dorsi and the inferior angle of the scapula; and finally, one beneath the same angle of the scapula and the chest-wall (*infra-serratus*).

Sub-acromial or Sub-deltoid Bursa.—This sac is quite often affected, and, owing to the somewhat peculiar symptoms to which its inflammation gives rise, I deem it worthy of an extended notice. It is probable that the so-called luxation of the long head of the biceps is really due to chronic bursitis of this sac, for all the symptoms attributed to that lesion are present in such an inflammation, with others which are irreconcilable with the existence of any displacement of the tendon.

Symptoms.—There is some wasting of the shoulder muscles in chronic cases. A fluctuating swelling, easily felt when the deltoid is relaxed, and bulging on either, but preferably on the anterior, side of the tendon, will often be found in chronic cases characterized by marked effusion. Pressure will perhaps drive the fluid from one side to the other, and under such circumstances melon-seed bodies can be detected slipping from beneath the fingers. If the arm is supported, its movements are not painful when it is applied to the side, but when unsupported, or when traction is made upon it, pain will follow movement. Pressing the joint surfaces together produces no discomfort. If the arm be abducted beyond a right angle, there will be pain, while at the same time a peculiar crackling sensation, sometimes accompanied by a feeling as of a foreign body slipping away under the acromion, will be felt. If the arm is brought to the side these symptoms will cease, and as the arm is depressed a slipping sensation, as if due to the reduction of a displaced tendon, will often be perceived. There will be more or less flexion of the forearm, due to rigidity of the biceps, and a feeling of fatigue at the bend of the elbow will be complained of.

It will be seen that these symptoms closely correspond to those which are said to be produced by luxation of the tendon of the biceps. Jarjavay,[1] disbelieving in luxation of the tendon, on the anatomical grounds that the exceptionally strong fibrous sheath by which it is bound down could not be ruptured without simultaneously tearing off the supra-spinatus tendon, and that such a degree of force would almost necessarily luxate the humerus, examined a number of patients with the following results. The seat of the most marked acuity of pain was on a line with the apex of the acromion, two and a half centimetres outside of the position of the tendon. Every movement except that of abduction merely produced slight discomfort, but during this movement the pain and crackling were marked. In extreme abduction, rotation either outwards or inwards produced similar pain and crackling, except when an assistant depressed the proximal extremity of the humerus by pressure over the upper part of the arm, whereby the two bursal surfaces were no longer nipped between the tuberosity of the humerus and the under surface of the acromion. By dividing the origin of the deltoid and laying the muscle up over the clavicle, the bursa will be exposed, when it will be easily seen that a twist of the arm, especially when either flexed or extended, may stretch or actually tear its walls. This is just the injury supposed to produce luxation of the biceps tendon. If now the arm be abducted, the bursal walls will be folded up so as to form a sort of collar in advance of the greater tuberosity of the humerus, so that it will be readily seen how, when thickened by inflammation, these now rigid plications will be compressed under the

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[1] Gazette des Hôp., Fév. 1868, p. 97.

acromion, and, when forced beneath it by the pressure of the humeral tube-rosity, will by rolling upon one another produce the crackling and slipping sensations. These are synchronous, and both correspond to a point two and a half centimetres *outside* of the line of the tendon. Persons following labori-ous occupations often present marked thickening of the bursal walls, with fibroid bands traversing the cavities. If an injury be now received, the sur-geon on examination will detect the symptoms already given, and may diagnose luxation of the biceps tendon. Jarjavay, in a case of undoubted acute bursitis of this sac, detected every one of the typical symptoms of such an injury.

Diagnosis.—Although many bursæ, when enlarged, may receive a trans-mitted pulsation from the artery, and so simulate aneurism, their mobility, the nature of the pulsation, etc., will readily eliminate any source of error. Strumous arthritis is the only affection likely to be confounded with a chro-nic bursitis of this sac. A review of the symptoms of bursitis, with a re-membrance of the fact that, except in abduction, motion produces only uneasiness, when the arm is supported, while the joint-surfaces can be pressed together without pain being developed, will insure a correct diagnosis. When the bursa communicates, as it often does, with the shoulder-joint, the disease may extend from the former to the latter, or *vice versa.*

Treatment.—The application of electricity to the weakened muscles, counter-irritation, and passive motion, are what Jarjavay has found efficient in the chronic cases; while in the acute, treatment must be conducted on general principles. No operation beyond antiseptic puncture or aspiration should be attempted for the cure of any enlarged bursa in this region. More severe measures so often result in serious consequences, that it would be bad surgery to run unnecessary risk when safer measures will suffice. The aspirator or exploring needle should be used to detect pus, which, if found, should be drawn off by the former instrument. If this fail to effect a cure, the suppu-rating sac should, of course, be laid open, but only antiseptically, as the bursa might communicate with the shoulder-joint.[1]

Sub-scapularis and Infra-spinatus Bursæ.—These are mentioned merely because, from their usually communicating with the joint, they are apt, when the latter is diseased, to become secondarily involved. When primarily affected, pain will be developed by drawing the arm away from the side, and at the same time rotating it either inwards or outwards; pressing the joint-surfaces together produces no discomfort.

Infra-serratus Bursa.—By this I mean the bursa situated between the inferior angle of the scapula and the chest-wall. It is not constant, but fre-quently present in those performing manual labor. I give prominence to the enlargement of this bursa, because of the peculiar friction-like crepitation or creaking which is not an infrequent precursor and concomitant of its forma-tion. This—most distinctly felt and heard over the inferior scapular angle—is propagated to the point of the shoulder, and even along the arm. This pseudo-crepitus has been mistaken, by careless or inexperienced observers, for either a fracture of the ribs or scapula, or for a dry arthritis of the shoulder-joint. Boinet was the first to point out this symptom, and Terrillon has written two able papers on it. To a very minor degree, this symptom can be developed in apparently healthy individuals, by strongly pressing the scapula against the thorax while the bone is forced to execute various movements.

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[1] "Hyper-distension" may be substituted for an antiseptic dressing, when the essentials for the latter are wanting.

For the production of this symptom, the scapula must be in such a position that its inferior angle is closely applied to the thorax. It is due to one of three conditions, viz., (1) an exostosis on the ribs or scapula, which has caused an absorption of the subscapular and serratus magnus muscles, thus allowing the two bony surfaces to come into contact; (2) a localized projection of the ribs due to a contraction of the chest, following pleurisy, for instance, with the same atrophy of the muscles; or, finally, (3) a primary atrophy of the muscles, such as is common in anchylosis of the scapulo-humeral joint, which will admit of the normal scapula and ribs coming in contact. This latter condition preëminently gives rise to exaggerated movement of the scapula, which is an important factor in the production of this bursa. All these conditions have been verified by actual post-mortem examination.

Symptoms.—The inferior angle of the scapula is raised by a fluctuating swelling, which bulges from beneath both the axillary and vertebral borders of the bone. The same portions of the bone are slightly raised in cases where the effusion is too slight for detection, as if from paresis of the muscles. There is marked feebleness of the shoulder, especially in elevating the arm. There is no tenderness, nor any symptom of disease of the subjacent ribs or neighboring vertebræ. The ordinary crackling from melon-seed bodies can be readily detected, but where there is much effusion, the peculiar "cracking" cannot be developed, owing to the separation of the two bony surfaces.

Diagnosis.—This can be readily made by remembering that any position of the upper extremity which prevents accurate contact of the inferior angle of the scapula with the thorax, will prevent either the hearing—for it is sometimes very loud—or the feeling of the crepitus. By bringing the arm, much elevated, firmly across the chest, the cracking cannot be elicited, so that the idea of fracture can be no longer entertained. By fixing the scapula in this position by means of an assistant, manipulation of the shoulder-joint—when the case is not due to anchylosis, true or false—will soon prove that the articulation is healthy.

Treatment.—The trapezius, rhomboids, elevator of the scapular angle, and serratus magnus, seem to be the weakened muscles. Electricity appears to be useless, so that Terrillon has been compelled to resort to a mechanical apparatus which firmly fixes the scapula against the chest-wall. This is the only remedy which has proved successful.

BURSÆ OF ELBOW AND VICINITY.

A bursa is situated beneath the brachialis anticus; another over each condyle of the humerus; one between the common origin of the extensor carpi radialis brevior and the extensor communis digitorum on one side, and the head of the radius on the other;[1] a subcutaneous one over the olecranon; another beneath the triceps tendon over the upper surface of the olecranon;[2] and one between the tubercle of the radius and the tendon of the biceps.[3] It is said that a bursa is sometimes found over the superior part of the left forearm in wall-paper manufacturers.

[1] I have seen, in one case, considerable inability to use the forearm in enlargement of this bursa, due probably to pressure upon the radial or posterior interosseous nerve.

[2] This is often a mere prolongation of the synovial capsule of the joint. (Barwell, Diseases of Joints, 1881, p. 488.)

[3] Dr. D. H. Agnew reports a case of chronic enlargement of this bursa, which, by pressure upon the median and posterior interosseous nerves, produced loss of power in the forearm muscles. (Transactions of the Pathological Society of Philadelphia, vol. ii. p. 139.)

SUBCUTANEOUS OLECRANAL BURSA.—Owing to its position, this sac is exceedingly apt to be contused or wounded. Such injuries, especially contused wounds, are apt to be followed by phlegmonous erysipelas of the whole upper extremity, involving even the axilla. In the old this may prove fatal.

DEEP OLECRANAL BURSA.—This is not always an independent sac, but a mere process of the synovial capsule of the joint. If it does not open into the joint, the diagnosis of enlargement of this bursa from joint-disease can be readily made by noting the absence in the former of "puffiness between the inner condyle and the olecranon process, when the arm is bent at right angles," . . . and by "the infallible test . . . that the line of junction between the head of the radius and the humerus is as clear and well defined as ever."[1]

Treatment of Bursal Enlargements about the Elbow.—Strict rest on a splint, with local and general antiphlogistics, should be tried. If phlegmonous erysipelas supervenes, early and free incisions, with supporting treatment, are indicated. Simple enlargements of the various elbow bursæ should be cautiously dealt with, owing to their relations to the joint. I once laid open the bursa over the head of the radius and packed it with lint; spreading cellulitis resulted, the joint became involved and was destroyed, and death resulted from septicæmia.

BURSÆ OF WRIST AND HAND.

Like those of the ankle, the bursæ of this region usually occur as bursæ synoviales (synovial sheaths for the tendons), and the consideration of their diseases belongs to another article. Those which may be fairly described as bursæ rather than synovial sheaths, are only two, viz: one over the styloid process of the radius, and another over that of the ulna. In the hand, bursæ are constant upon both the dorsal and palmar surfaces of the metacarpophalangeal articulations; over the dorsal surface of the inter-phalangeal joints; occasionally over the radial border of the first phalanx of the forefinger of the right hand, in joiners; over the posterior faces of the second and fifth metacarpals of the right hand, in workmen manufacturing wall-papers;[2] and over the first inter-phalangeal joint of the right index finger in writers.

Nothing special need be said of the bursæ of the wrist, which have been sufficiently considered in speaking of synovial herniæ. Those of the hand cannot be so cursorily dealt with, since the bursæ over the dorsal aspect of the inter-phalangeal joints, especially that of the forefinger, and also those of both the dorsal and palmar aspects of the metacarpo-phalangeal joints, are subject to a painful form of enlargement. Rheumatic and gouty individuals are the chief if not only sufferers, unless traumatism be the exciting cause. Usually these enlargements appear to be caused merely by the natural use of the parts. Perhaps prolonged writing or other light manual labor may be the starting point. The same amount and severity of work in any other than a rheumatic or gouty individual would produce nothing beyond temporary fatigue. The affected parts swell, become painful, stiff, and tender. All the symptoms are worse on rising in the morning, and are ameliorated during the day. Rest at first entirely relieves the trouble, but the least exercise renews it; the periarthritic tissues crepitate when pressed upon, thickening results, and the member becomes almost useless. The weather evidently affects the parts, and intercurrent attacks, affecting other bursæ, or perhaps joints, are not uncommon.

[1] Barwell, op. cit.   [2] My authority refers to French workmen.

Teno-synovitis usually coexists, or at least appears to do so. The diagnosis is too manifest to need further words.

Treatment.—The success of this depends upon the recognition of the constitutional vice. The part should be put at perfect rest until most of the local heat and tenderness have disappeared. A light vulcanite splint, moulded to the finger, so as to keep it semi-flexed, or some similar arrangement, should be employed. Absorbent cotton, wet with a five-per-cent. solution of lactic acid, should be kept applied, unless the skin becomes sore, when some sedative astringent, such as hammamelis, can be used. Or, again, spirit lotions, containing various proportions of iodide of potassium, applied in the same manner, will prove efficacious. After the disease becomes more chronic, the surgeon must remember not to keep the joint quiet too long for fear of anchylosis. Passive and active movement, cautiously made, rubbing, and hot alkaline bathing or douching, should be used. At times the judicious application of the thermo-cautery, heated in boiling water, may prove useful. Usually mere reddening of the skin is all-sufficient, but occasionally blistering by this means will be necessary, before any useful result can be obtained. An elastic rubber bandage often serves an admirable purpose in removing the remaining stiffness and thickening of the inter-phalangeal joints. This bandage should be cut from a strong rubber capote, since no other rubber tissue is thin enough, and may be secured by a piece of bobbin attached to one end.

Constitutional and strict dietetic treatment are of paramount importance. Iodide of potassium, in small doses, guarded by muriate of ammonium, either with or without colchicum; the natural alkaline waters; and, above all, a residence at some appropriate spa, will act better than any mere local measures. The Hot Sulphur Springs of Virginia or Florida, the Richfield Springs, or the Buffalo or Wolf Trap Lithia Springs, are the best in this country. The only natural water used at the patient's house, of which I have any experience, is the Buffalo Lithia water, which I have used with undoubted advantage in my own person. It should be taken in large quantities and for a long time. Having had no personal acquaintance with the effects of the English and Continental natural waters, I prefer to refer my readers to such writers as Barwell and others who have had ample experience in the treatment of rheumatic and gouty affections by such means.[1] If any surgeon who reads this has had the care of one of these annoying cases, no apology will be needed for this extended notice. The disease is so incapacitating, and so difficult of cure, that having had successful personal experience in its treatment, I am glad to be able to add my mite to the knowledge of its therapeutics. It is essentially a chronic affection, and, in consequence, treatment must be persisted in for months and even years; but I believe that in the end most cases can be cured, or that at least the disease can be so kept in abeyance that the patients practically recover.[2]

BURSÆ OF THE ISCHIO-FEMORAL REGION.

A large bursa exists between the ilio-psoas muscle and the capsule of the hip-joint, with which in adults it communicates; another, subtegumentary, is often found over the trochanter major; one is present between the trochanter major and the gluteus medius, and often extends betwixt the tendon of this muscle and that of the pyriformis although at times there is a separate

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[1] Barwell, op. cit., p. 398.

[2] Of course the distinction between "tonic" and "atonic" gout must be made with reference to treatment. The reader is referred to Barwell (Diseases of the Joints, London, 1881, pp. 220–245), for much valuable advice as to the treatment of rheumatic and gouty arthritis, much of which is applicable to the therapeutics of the variety of disease which I am here describing.

bursa for the latter. A bursa is interposed between the tendon of the gluteus minimus muscle and the great trochanter; another between the lower part of the trochanter and the contiguous portion of the shaft of the femur, and the tendon of the gluteus maximus; below this, a second between the tendons of the gluteus maximus and the vastus externus muscles; one beneath the pectineus, near its insertion into the femur; and one between the external obturator muscle and the back of the neck of the femur. A large bursa is found between the quadratus femoris and the lesser trochanter; one between the trochlear groove of the ischium and the tendon of the obturator internus, often communicating with another, quite commonly present, which is situated between the back of the capsule and the gemelli, and the obturator internus ; bursal interspaces exist between the obturator internus, the quadratus femoris, and the back of the capsule; a bursa is found beneath the conjoined tendon of the semitendinosus and biceps; another beneath the origin of the semi-membranosus · and an accidental one over the upper and outer part of the thigh.

ILIO-PSOAS BURSA.—When enlarged, this presents a fluctuating tumor over the front and inner part of the thigh. It may reach a large size, even that of a child's head, and may have portions which feel hard to the touch. When suppuration occurs, the pus points below the edge of the great gluteal muscle to the outer side of the femoral vessels, or in both situations. The subjacent pelvic bones were necrotic in one reported case. The limb is flexed from irritation of the ilio-psoas muscle, and to remove pressure from the inflamed sac, and in consequence a varying degree of lameness results.

Diagnosis.—This affection can hardly be confounded with any other except hip-disease, the differential diagnosis from which will be presently referred to. From *femoral hernia* it can be distinguished by the absence of impulse on coughing, of resonance on percussion, and of the characteristic sensation when reduced—supposing it to be possible in a given case, when very small, to force the contents into the hip-joint—and by the internal position of the femoral vessels. From *psoas abscess* it may be distinguished by the absence of signs of caries of the vertebræ, and by the history. From *coxalgia* it can be distinguished by the absence of pain on pressure over or behind the trochanter major, and by the fact that, by cautious manipulation, flexion can be freely made without elevation of the pelvis. This cannot be done in hip-disease, since, after a limited degree of flexion has been attained, the pelvis, in that affection, moves with the femur. If the ilio-psoas muscle be relaxed, no pain should be experienced in bursal inflammation when the head of the femur is forced into the acetabulum, either directly by pressure or blows on the trochanter, or indirectly by force applied to the knee. Of course no grating can be detected in moving the joint even under anæsthesia. The pain is never referred to the knee.

Barwell[1] calls attention to the pain over the origin of the gracilis and adductor muscles, which is common to bursitis of this sac and impacted fracture of the femoral neck. I can hardly think that there is any likelihood of the two affections being confounded, and refer to the subject merely because so distinguished an authority as Mr. Barwell has considered the mistake possible.

Treatment.—As this sac usually communicates with the hip-joint, aspiration alone should be resorted to, followed by the use of blisters and pressure. If pus forms, and is evidently making its way to the surface, should aspiration fail, a free opening must be made with the strictest antiseptic precautions.[2] Any

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[1] Diseases of Joints, 1881, p. 489.
[2] Shaeffer reports (Centralblatt f. Chir., 1880, Bd. xvi. S. 433) a case of suppuration of the ilio-psoas bursa where the sac opened into the articulation, in which treatment by incision and drainage was followed by recovery with a movable joint. I have not seen the original paper, but only an abstract which gives the above facts.

resulting sinuses, necrosis, etc., must be treated on general principles, always bearing in mind the proximity of the hip-capsule, and the liability of the joint to become involved.

BURSA OF THE GLUTEUS MAXIMUS.—The importance of recognizing disease located in this bursa will become clear when its affections are described. It is probable that caries of the trochanter sometimes arises from suppuration of this bursa.[1] The patient will probably refer the disease to a severe blow received some time previously over the trochanter major, which produced temporary pain and lameness, and was followed by low inflammation, wasting of the thigh, and flattening of the buttock. When seen by the surgeon, the thigh is usually adducted[2] and flexed upon the pelvis, which follows the motions impressed on the femur. In certain cases there is a decided simulation of lengthening of the limb, and the trochanter is prominent, and seemingly lower than on the healthy side. Extension or rotation inwards, which puts the gluteal muscles on the stretch, immediately causes pain, not in the joint, but over the trochanter and upper part of the thigh. Pain in the joint can neither be elicited by forcing its surfaces together by pressure on the trochanter, nor by the upward force imparted to the femoral head by blows, etc., upon the knee, although local pain of varying violence may be complained of over the trochanter when this is pressed upon. Suppuration occurs slowly, often forming large accumulations, which finally burst, usually with marked amelioration of all the symptoms. In some cases all the movements of the joint now become free and painless, and the patient rapidly and permanently recovers. In others, either a slow and tedious recovery takes place, or, a sinus resulting, the case closely simulates one of hip-disease.

Diagnosis.—Although a careful consideration of the above-named characteristics of the disease should always lead to a correct opinion, yet, as such cases have been mistaken by experienced surgeons for morbus coxarius, the symptoms already given may be recapitulated, with some additional points. There is always a history of a violent blow upon the trochanter, which is usually rapidly followed by swelling over the injured region. There is no pain in the hip itself, nor any referred pain in the knee. Although of necessity pressure behind the trochanter gives pain, pressure applied in the groin reveals no tenderness, and under an anæsthetic the joint movements are found to be perfectly free and natural. Exploration of the sinuses, when such exist, will detect no bare bone, and will show that the disease is confined to the bursa. The rapid recovery after the pus is evacuated, with the restoration of the joint movements, is in marked contradistinction to what is seen where suppuration occurs in the hip-joint itself. Mr. Teale[3] hints that certain of the reported cases of rapid recovery, after opening of supposed psoas abscesses, may have been unrecognized cases of disease of the trochanteric bursa.

Treatment.—If the collection is large, aspiration or antiseptic incision should be practised. Should sinuses result, they must be dilated, when the introduction of the finger will readily detect the cause of the slow healing, viz., the constriction and pressure upon the diseased parts by the flat tendon of the gluteus maximus, which must be freely divided transversely. The lining false membrane, etc., should then be broken up by the finger, and the case treated on general principles.[4]

ISCHIAL BURSÆ.—Any of those mentioned may become involved. The disease occurs most frequently in persons whose occupations demand a sitting

[1] T. P. Teale, Lancet, 1870.
[3] Loc. cit.
[2] Macnab, Lancet, Nov. 12, 1870.
[4] T. P. Teale, loc. cit.

posture with an occasional gliding movement, such as weavers and boatmen, whence the names of "Spittalsfields weavers" and "lighterman's bottom." If suppuration occur, troublesome sinuses are apt to result, which must be treated on general principles, by setons or stimulating injections, followed by pressure or appropriate incisions, when such can be safely and advantageously practised. More commonly, however, the bursal walls become much thickened, when either excision by careful dissection, or Volkmann's "antiseptic incision," should be resorted to.[1]

OBTURATOR INTERNUS BURSA.—I merely mention the following case incidentally, since its result apparently indicates what is the proper operative treatment for any of the other numerous hip bursæ, if they become enlarged, but do not suppurate. The tumor occurred in the person of a medical man of markedly rheumatic diathesis, and was diagnosed by being rendered tense and prominent only when the obturator internus muscle contracted. Puncture resulted in a rapid and permanent cure. In similar cases appropriate constitutional remedies should be tried, and if these, conjoined with rest, fail, puncture by the aspirator should then be resorted to. Blisters and pressure, for the reasons pointed out when speaking of such remedies, cannot prove useful in any marked degree, owing to the deep situation of this as of most of the other hip bursæ.

ANTERIOR BURSÆ OF KNEE AND VICINITY.

A bursa quite commonly develops over the external and anterior face of the thigh in street organ-grinders, while in shoemakers one situated more anteriorly and internally sometimes occurs. About the knee, a number are found. One of large size is usually developed beneath the quadriceps tendon (the *sub-quadricipital*), which often opens into the joint. This may become enlarged in sewing-machine girls who start their machines with the knee. Bursæ are usually found over both the internal and external femoral condyles. One, which is sometimes multiple, is situated over the patella (the *pre-patellar*); one over the tubercle of the tibia (the *subcutaneous pre-tibial*); another between the tibial tubercle and the ligamentum patellæ (the *deep pre-tibial*); and one or more beneath the gracilis, semi-tendinosus, and sartorius tendons, the so-called *patte d'oie* tendons of the French.

BURSA BENEATH VASTUS INTERNUS. — This is occasionally diseased. It sometimes gives rise to obscure symptoms, apparently due to disease of the knee-joint. It is commonly the result of a blow in this region, resulting in an inflammation of this sac, which is accompanied by acute pain, easily relieved by rest and treatment. Recurrent attacks on over-exertion are common, and the limb is weakened.

Diagnosis.—This depends on a history of direct injury, and the tardy progress of the disease, with occasional attacks of inflammation which produce lameness and interfere with flexion—all being due to the development of an oval, hard, tender tumor, under the insertion of the vastus internus, which can be grasped between the fingers and moved, when the muscle is relaxed, but which cannot be detected when it is tense.

Treatment.—This consists of the enforcement of rest and the local use of antiphlogistics.

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[1] See Treatment of Acute and Chronic Bursitis.

SUB-QUADRICIPITAL BURSA.—Effusion into this sac gives rise to a swelling of variable size, which bulges out on either side of the rectus tendon. At first sight it closely resembles acute synovitis of the knee. The swelling is painful and fluctuating, and may give rise to marked constitutional reaction; but it is situated above the patella, the upper border of which is its lowest limit, while the two distended fluctuating pouches which in synovitis of the knee-joint are found on either side of the ligamentum patellæ, are absent. The difference is most evident in the erect posture. The patella is not elevated and floated off from the patellar surface of the femur, and in consequence the characteristic tap against the latter bone, observed in synovitis, with the subsequent recoil after the removal of pressure, cannot be elicited. The diagnosis must depend upon the recognition of these symptoms.

Treatment.—When simply inflamed, the treatment recommended for bursitis in general is all that is necessary. Should suppuration occur, aspiration should always be preferred to incision, since this bursa very commonly communicates with the joint in those of advanced years, while such a condition has been observed even in the young. It may not be possible to empty the bursal contents into the joint, owing to the valvular nature of the opening, so that the most prudent plan is in all cases to aspirate, except when the condition of the skin renders it probable that the opening made by the trocar will ulcerate, when the knife under antiseptic precautions may be resorted to. Some one of the bursæ in the region of the knee—and these remarks are equally applicable to other joints—is usually the starting-point of the periarthritic suppuration which so often results in serious injury of the articulation, and occasionally in its destruction. Proper treatment and free opening, thus insuring drainage, will usually prevent damage. The differential diagnosis between intra-articular and peri-articular suppuration mainly depends upon the form assumed by the swelling, and upon whether the patella is floated off from the femur or not.

PRE-PATELLAR BURSA.—This may or may not be of ante-natal formation.[1] This bursa is often traversed by imperfect partitions, and there may be two or more separate sacs. The septa becoming thickened and more vascular, when the bursa is inflamed or irritated, may be ruptured, accounting for some of the blood found in the effusion, and for the rolled-up masses of threads, either attached or free, which are so commonly noticed. Owing to its position, which exposes it to falls, pressure, and friction—in house-maids, stone-masons, *religieuses*, etc.—this sac is more commonly enlarged than any other. Both the acute and chronic forms are often due to the effusion of blood, which undergoes manifold changes and gives rise to various grades of inflammation. The term "house-maid's knee" is applied to chronic enlargement of this bursa, from its frequent occurrence among domestic servants abroad, although not in this country. Traumatism usually sets up an acute bursitis.[2]

Acute Bursitis of the Pre-patellar Bursa.—This subject will be treated of somewhat in detail, as suppuration, both in the case of this bursa as well as in that of the others surrounding the knee, is thought by most authors to be the starting-point of peri-arthritic suppuration. When the pre-patellar bursa is acutely inflamed, the anterior aspect of the patella presents a more or less tense, tender, fluctuating swelling, the skin over which is much reddened. The pain is often of a violent, lancinating character. After a few days the

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[1] Hamilton's Surgery, p. 469; also A. Pineau, Étude sur les Épanchements des Bourses Séreuses Sous-cutanées. Paris, 1866.

[2] Angeioleucitis has been known to give rise to suppurative bursitis. Pineau, op. cit.

redness, which was at first circumscribed, becomes diffused, and some œdema is observed. Occasionally, when no history of a blow can be elicited, marked ecchymosis may appear, extending down even to the ankle. Although there is no absolute rule on the subject, inflammation arising from traumatism does not usually show itself for from twelve to forty-eight hours after the injury. The knee is usually somewhat flexed, movements of either flexion or extension being painful, or at least difficult. Fever, headache, furred tongue, and confined bowels, are quite common. Acute bursitis may terminate by resolution or suppuration, or may pass into the chronic form. Acute suppuration has even terminated fatally from septicæmia. Caries of the patella from suppurating bursitis, which resulted, after operative interference, in suppuration in the joint, has been once observed by Erichsen.[1] When acute bursitis of this sac arises from gout or rheumatism, resolution is the rule. Under such circumstances the onset of the disease is violent, but it subsides quickly, perhaps to again recur.

Diagnosis.—In a case of moderate severity this is easy. but when dealing with a very marked bursitis, the question of diffuse cellul`tis arises. The correspondence of the tumor with the site of the bursa, its manifest fluctuation from the outset, and the distinct interval between the injury and the appearance of the swelling, are the most reliable points.[2] The rapid appearance, disappearance, and perhaps reappearance of the disease, coinciding with manifestations of gout or rheumatism elsewhere, indicate its dependence on systemic causes.

Treatment.—Local antiphlogistic measures, aided by constitutional remedies (for rheumatism, etc.), if so indicated, should be prescribed.[3] I would caution against the use of the knife, unless pus is certainly present, as death has thus more than once resulted. The presence of pus, unless by the use of the exploring needle, can only be positively determined by the skin becoming purplish and red, and thinning more and more. When pus is present, free incisions must be made, as they must also when phlegmonous erysipelas supervenes, in which case a supporting treatment must be instituted, with iron, quinine, etc. When the bursitis is due to gout or rheumatism, alkalies, salicylic acid or the salicylates, colchicum, etc., must be exhibited.

Chronic Bursitis.[4]—True hygroma of this bursa, as before defined, does sometimes occur, but the more common form of "house-maid's knee" is really either an acute or a chronic bursitis. In the latter case we find a[5] firm, tense, hemispherical tumor, which projects from the anterior surface of the patella. It may reach the size of a fœtal head, but more commonly is not larger than a small orange. Usually confined to the anterior surface of the patella, it may project beyond, overlapping this bone, and coming into close relation with the anterior surface of the joint-capsule. If the walls are only moderately thickened, and if the sac is not too tensely filled, fluctuation is readily detected. Not uncommonly the walls are so thickened that the growth simulates a solid tumor, which is only proved to be cystic when, after removal, a section is made, revealing a larger or smaller central cavity or cavities filled with some kind of fluid. Slight stiffness and interference with extreme flexion are commonly complained of, or a sense of soreness after prolonged exercise. Tumors, solid from the outset, are met with here, but

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[1] Science and Art of Surgery, vol. ii. p. 335.
[2] Nélaton, quoted by Pineau, op. cit.   [3] See page 693, for details.
[4] For a detailed description of the pathological anatomy, appearances, degenerations, etc., see opening portion of this article.
[5] A. Pineau mentions a case of M. Leroy's, where three closely related tumors existed. (Op. cit.)

are due to syphilis, being of a gummatous nature. The much thickened, chronically inflamed bursæ are liable to attacks of acute inflammation, effusions of blood, etc., from any traumatic causes, such as blows or falls. They are apt under such circumstances, chiefly in syphilitic subjects, to become gangrenous and slough out *en masse*, when fungous granulations or troublesome sinuses may result. Melon-seed bodies are often met with. Chalk-stones have been observed in a case of chronic gouty bursitis of this sac.[1] Subcutaneous rupture sometimes occurs, and even the skin may give way. A cure rarely results from the former accident, and the latter is too seldom met with to justify generalization as to its effect.

Diagnosis.—The only point requiring care is to determine as to the existence or not of marked thickening of the sac-walls, the treatment varying according to whether such a condition is or is not present.

Treatment.—In true hygroma,[2] rest on a splint, the use of blisters, the pressure exerted by an elastic bandage or any other convenient means, with, in very voluminous tumors, a preliminary aspiration, will effect a rapid cure. The same plan will often succeed where the walls are not much thickened by inflammatory deposits. If the walls are markedly thickened, tapping, the employment of blisters, and pressure, with or without a preliminary subcutaneous scarification of the interior of the sac with a tenotome, may be tried. If these expedients fail, the antiseptic or ordinary seton may be resorted to, taking care that the lower opening is kept patent. In the apparently solid forms of bursitis, nothing short of excision, or Volkmann's antiseptic incision, will avail. I totally disapprove of incision followed by packing with lint, for reasons already given. On excising these growths, great care must be taken not to cut the fibrous hood formed by the lateral expansions of the quadriceps tendon, as unpleasant burrowing of pus might ensue. This accident could only happen in the case of a large tumor which overlapped the patella. Such a mishap can readily be avoided by always keeping the knife-edge directed towards the growth. The incision itself should be lateral, so as to escape pressure, and, where possible, Packard's oblique incision should be tried. Whatever the treatment, a relapse may occur, the continuous pressure and friction to which the parts are subjected giving rise to a new bursa, which in turn may become enlarged. This is, of course, excessively rare.

PRE-TIBIAL BURSA.—Inflammation of this bursa gives rise to an ill-defined, small, tender swelling, which can be most readily felt on either side of the ligamentum patellæ, over the most prominent portions of the tibial tubercle. Sometimes the swelling can be felt more easily on one side than on the other. Enlargement of this bursa is quite common. It is more painful than that of the pre-patellar bursa, and interferes more with the movements of the knee-joint, owing to its being compressed between the tendon and the bone. The various measures suggested for acute bursitis, or even the actual cautery, should be tried. The disease is most commonly seen in rapidly-growing boys, about the age of puberty, and has been mistaken for osteitis. It often lasts for years, and interferes with exercise.[3] Nothing should be attempted in the operative line, beyond aspiration, without the strictest antiseptic precautions, as the bursa sometimes communicates with the knee-joint. An unfortunate result occurred in two of three cases mentioned by Hamilton—two having been reported by Monro and one by himself. In one of Monro's patients, in whom the sac was opened by a valvular incision, suppuration in the knee-joint occurred, necessitating amputation, while in another,

[1] Maunder, Clin. Lect. and Rep. Lond. Hosp., 1867–8, vol. iv. p. 258.
[2] See Section on Hygroma.   [3] Barwell, op. cit., p. 490.

similarly treated, no good resulted.   Hamilton's patient died after the intro-
duction of a seton.

BURSA OF THE SEMI-TENDINOSUS, SARTORIUS, AND GRACILIS MUSCLES.—The
bursa common to these, which may be prolonged between the tendons—or the
separate sacs which are occasionally found between any two of them—may
become enlarged.   The French call these tendons the "*patte d'oie.*"   When
suppuration occurs, tedious and troublesome sinuses sometimes result.   This
is one of the most commonly affected bursæ in tertiary syphilis.

POPLITEAL BURSÆ.

Enlargements of these bursæ are of special interest to the surgeon, because
they, even more than synovial herniæ, are apt to be mistaken for aneurisms.
In fact, notwitsthanding Mr. Bryant's assertion to the contrary, a recent writer
of experience declares that, after all, the chief point of difference in certain
cases is merely that the distensile impulse is not as powerful as would be ex-
pected in a thin-walled aneurism free from any deposition of clot.   Still, with
care such a blunder can be avoided.   Suppuration in these bursæ has resulted
in contraction of the knee from cicatrization.   It will be well to first enume-
rate the bursæ normally present here.   Special attention should be paid as
to which do and which do not usually communicate with the knee-joint, as
upon the answer to this question depends largely the nature of the treatment
which should be pursued.

From their connection with the tendons, these bursæ are necessarily situated
along the internal and external borders of the popliteal space.   There are but
two at the inner side of the ham.   One, the largest, is situated between the
inner condyle of the femur and the inner head of the gastrocnemius, together
with the semi-membranosus, between which muscles it sends a process.   It
extends from the posterior inferior part of the internal femoral condyle to the
back of the inner tuberosity of the head of the tibia, reaching even as low
down as the upper border of the popliteus muscle.   The outer border should
not be detectable beyond the head of the gastrocnemius, while its inner por-
tion extends beneath the tendon of the semi-membranosus.   It is occasionally
more or less subdivided into a moiety for each of these two muscles.   After
adult age it usually communicates with the knee-joint.   The second internal
popliteal bursa is found between the tendon of the semi-membranosus muscle
and the internal tuberosity of the tibia, is obliquely situated, and is of small
size.   At times it communicates with the bursa previously described, and
still more rarely, yet occasionally, with the knee-joint itself.

Externally, four bursæ are usually met with.   One, which will be found
between the popliteus tendon and the external lateral ligament, does not usu-
ally, although it may, communicate with the joint; a second, however, placed
obliquely between the tendon of the popliteus and the external tuberosity of
the tibia, does so communicate, being, in fact, but a diverticulum of the synovial
capsule of the knee.   In a large proportion of cases, this large bursa also opens
into the superior tibio-fibular joint.   The remaining two bursæ are by no means
constant, although of frequent occurrence.   One is situated above the head
of the fibula, being interposed between the biceps tendon and the external
lateral ligament of the knee joint.   The external popliteal nerve runs along
this bursa, a circumstance which may explain some of the pain experienced
from its enlargement.   The fourth and last is, when present, placed between
the external condyle of the femur and the external head of the gastrocnemius.
Its place is often taken by a prolongation of the bursa between the popliteus

and the external lateral ligament. Thus, of the six popliteal bursæ, one always communicates with the joint (the *sub-popliteus*); one generally does so (the *gastrocnemio-semimembranosus*); while a third does so occasionally, viz: that between the external lateral ligament and the popliteus tendon.

Any occupations which demand prolonged muscular exertion, such as those of porters, soldiers, etc., undoubtedly predispose to enlargement of these bursæ, and in accordance with this fact they are of most frequent occurrence between the ages of twenty and thirty years. In a certain number of cases, the exciting cause also has clearly been over-exercise or a strain, but in most cases no special cause can be detected.

Symptoms.—These tumors are indolent, firm, elastic, of an ovoid form, and regular in their outlines, although in certain rare instances they may be lobulated or bosselated. They are little or not at all mobile, according to most authorities (McEwen, Foucher), although Erichsen gives mobility as a diagnostic mark. The superjacent skin is neither adherent nor discolored. They are usually of slow growth, and may lessen in bulk during rest in bed, but may rapidly develop, occasionally even in a few hours reaching the size of a hen's egg. This latter mode of development has been only noticed after some violent effort or extreme over-exercise. Tenderness is rarely complained of, even on firm pressure. A certain amount of stiffness and of dull pain is usually felt. Some patients experience frequently recurring attacks of cramp-like pain in the calf-muscles, especially after walking. When suddenly developed, or when a chronic swelling becomes rapidly enlarged, some tenderness on pressure may be felt for a time, but soon the tumor resumes its ordinary indolent condition. Fluctuation, according to Foucher, can be readily detected unless the sac-walls are much thickened, or when over-distension exists. This fluctuation can rarely be detected in the *extended*, but usually quite readily in the *flexed* position of the knee. This is a diagnostic point of the greatest importance.

The irregular, lobulated, or bosselated form, very rarely seen, is due to one or all of the following conditions. The tumor lying beneath the tendon may be constricted by it, especially when the muscle is tense; the bursal sac may be traversed by bridles, or partially divided into several compartments by incomplete partitions which render impossible its assuming the usual smooth ovoid form when distended by fluid; or its relations with the surrounding parts may be such as only to admit of easy distension at certain points. These tumors are ordinarily but slightly mobile, owing to their connection with the tendons. By the traction of the surrounding parts, a portion of the sac may become elongated, thus forming a pedicle, which will admit of these tumors changing their positions; again, actual rupture of the pedicle may occur, when a free unattached cyst will result.

As to the frequency with which they communicate with the joint, Foucher[1] shows that in 6 out of 12 of his cases, situated on the inner side of the popliteal space, the tumor was reducible; it was so in 1 out of 4 cases of those situated externally; while 2 out of 3 of the median cysts could have their contents emptied into the articulation. These latter, Foucher thinks, may have been synovial herniæ, although he expresses considerable doubt on this head. Joint effusion most commonly accompanies the median cysts, although not restricted to this class of cases. Foucher points out that error may arise from the apparent disappearance of the tumor when the joint is flexed; this can be avoided by deep pressure with the fingers, when the tumor, if not really emptied of its contents, can always be detected by careful manipulation. Coincident effu-

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[1] Archives Gén. de Médecine, 1856.

sion into the joint is rare,[1] and may be primary or consecutive. There is usually no tendency towards cure, the best to be hoped for being a stationary condition of the tumor. Occasionally rupture occurs with a more or less permanent recovery.

Diagnosis.—Several other diseases having their seat in the popliteal region might possibly be mistaken for enlarged bursæ. *Varix of the short saphena vein* may be simply mentioned in this connection. The *lymphatic glands* of the ham are occasionally enlarged, but rarely suppurate, and, in consequence, present no symptoms of fluctuation. They surround the artery more or less closely, and are much more liable to be mistaken for an aneurism than for a diseased bursa. Although some enlarged bursæ reach to the central line, they do not commence at this point, and usually in some position of the limb show elasticity or fluctuation. In the case of enlarged glands, inflamed lymphatics would almost inevitably be traceable, leading from some injury or sore into the popliteal space. *Suppuration beneath the popliteal fascia* would present more pain and constitutional reaction than a simple bursitis, unless it too had reached the stage of suppuration, when the conditions would be practically the same. A *cold abscess* would present antecedent morbid conditions not seen in cases of enlarged bursæ, and would occupy no definite seat, such as one border of the ham. In addition, the subcutaneous tissue would, at some stage of the case, be œdematous and pit on pressure. A *malignant growth* would cause enlargement of the superficial veins, thinning and discoloration of the skin, an almost certain involvement of the neighboring lymphatic glands, with, sooner or later, infiltration of the surrounding tissues. If mobile and circumscribed at first, it would soon become fixed and blended with the neighboring parts. The only *benign growth* likely to be confounded with an enlarged popliteal bursa is a lipoma, and that probably only in the rare event of the enlarged sac being bosselated. A fatty growth would probably occupy no specially defined position in the ham, it would not have a sharply defined outline, and it would not become larger and more tense when the limb was extended. Again, the deep surface of the skin is frequently attached to a fatty tumor, which is never the case with a bursa, unless suppurating.

GASTROCNEMIO-SEMIMEMBRANOSUS BURSA.—This, as before said, is the largest and most constant of the popliteal bursæ, and the one most commonly affected. Out of thirty cases of enlarged popliteal bursæ collected by Foucher, this sac was diseased in two-thirds. Usually no cause is assigned other than extra fatigue from walking. I am convinced, both from personal experience and from the cases published by others, that although over-exercise may be the exciting cause, rheumatism or gout is what renders it efficient. When this sac is affected, considerable dull pain will usually be complained of, with stiffness in walking. Occasionally, shooting pains extending down the leg may be felt. Although the patient will probably state that the knee is affected, nothing abnormal will be detected until the postero-internal border of the popliteal space is examined, when an oval, tense, firm, thin-walled tumor will be detected, over which the skin is freely movable, although the swelling itself is immobile. Its long axis may be oblique from above downwards and inwards, or longitudinal. In the former case the upper part of the swelling will reach the centre of the popliteal space, extending perhaps above the femoral condyle, while its lower part will reach to the inner side of the same region. When

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[1] Median cysts which are often accompanied by joint effusion are of rare occurrence according to Foucher.

the swelling is of large size, these bursæ sometimes occupy the centre of the popliteal space. When tensely filled by the effusion, the tumor is usually large, in one reported case measuring 5 inches in its long diameter, and 3.5 inches transversely.

While the tumor is always tense in the extended position of the limb, it is less prominent, slightly elastic, and even occasionally fluctuating when the knee is slightly or perhaps semiflexed. When slightly flexed, in the event of the sac communicating with the joint, the fluid can be pressed into the inner portion of the articulation, which will bulge, although the patella may not be lifted from its normal position. When partially emptied, fluctuation can be detected, and the pulsation transmitted from the femoral artery, in one case reported by McEwen, ceased to be distensile, becoming merely heaving. Pressure upon the femoral artery and sac may possibly appear to slightly diminish the size of the tumor, but the passage of the fluid into the joint can then be detected. Pulsation and bruit are usually both present, the former often being of a distensile character. By more or less flexing the limb, the degree and character of this vary. When simply of a heaving character, the diagnosis is plain.

Diagnosis.—As this is the only normal bursa in this region liable to be mistaken for aneurism, its differential diagnosis only, from that affection, need be considered. This must depend upon the character of the pulsation, bruit, etc. If the pulsation be simply heaving, the case will be clear enough. If distensile, it will not be as energetic as that of a thin-walled aneurism should be.[1] While most distinct when the limb is fully extended, and when the patient is in the recumbent position, slight flexion will markedly diminish the pulsation, or cause its entire disappearance. This is almost pathognomonic. When so flexed, the tumor not uncommonly shows signs of fluctuation, and it in great part disappears.[2] Such a position would not, in any way, much less in the manner indicated, appreciably affect an aneurism, since, although extreme flexion might empty it and arrest its pulsation, slight bending of the knee would merely render the pulsation more evident and more under control. Complete extension makes the bursal pulsation marked, but renders that of an aneurism slightly less evident. Pressure on the femoral above the bursa arrests the pulsation, but does not reduce the bulk of the tumor, unless in the rare case where pressure on the bursal sac at the same time empties part of its contents into the joint, which then becomes distended either locally or generally. Again this emptying of the sac is impossible in most instances, except in one certain position, usually that of slight flexion. An aneurism can be emptied in any position. In one recorded instance, where distensile pulsation occurred with emptying of the sac by pressure, besides the bulging of the knee-joint, the sac remained empty for some time, until the patient walked. This is in marked contradistinction to that rapid filling of a thin-walled aneurismal sac, *pari passu* with each pulsation, which is so readily distinguished by the eye. The bursal sac can also be emptied as easily without as with pressure on the vessel.[3] The upright posture, in one case of McEwen's, almost totally suspended the distensile character of the pulsation. No thrill has been observed in any reported instance, although having personally suffered from two enlarged bursæ in this region, my attention was first called to the disease by a distinct thrilling sensation in the limb, which led me to feel in the popliteal space, where, much to my surprise, I discovered a tumor. No such symptom, however, was detectable by palpation, but the pulsation was distinct in the extended, although not in the semiflexed position of the limb.

[1] McEwen, Glasgow Med. Journal, 1876, p. 468. [2] McEwen, loc. cit.
[3] Barwell, op. cit., p. 507.

In many cases the bruit is marked, but distant, not immediately under the ear, as would be the case in a thin-walled aneurism.

I have dwelt thus minutely upon the differential diagnosis of an enlargement of this bursa from aneurism, at the expense of some repetition, as it occasionally presents a puzzling problem not only to the tyro but to the experienced surgeon. Bryant reports a case of solid chronic enlargement of this bursa, which filled the whole popliteal space. It was movable, but, as the operation demonstrated, attached to the inner ham-string tendons. Its nature was not suspected, nor its attachments made out, until the incision was made. Mr. Bryant removed the bulk of the tumor down to its central cavity, which was of the size of a walnut, but left the deeper portions. Suppuration occurred in the knee-joint, necessitating amputation. Mr. Bryant confesses his inability to give the points necessary for a correct diagnosis, but records the case so that, others knowing that a solid bursal enlargement may occur in this locality, future errors may be avoided.[1]

Treatment.—Aspiration, followed by firm pressure, with the limb kept quiet on a splint, seems to have proved successful in cases where any operation has been indicated. In many instances the removal of the cause, viz., over-exercise, and the internal administration of constitutional remedies, if gout or rheumatism is proved or suspected, with the inunction of compound iodine ointment, and rest on a splint, will prove amply sufficient. Firm pressure, following the use of blisters, also proves useful in certain cases.[2] As a constitutional remedy, I have been pleased with the action of the Buffalo Lithia Spring water, given persistently in large doses. Recorded cases where incisions into this bursa, as well as into the others which occasionally open into the articulation, have resulted in suppuration of the knee-joint, followed by amputation, and even by death, warn us that aspiration should be the most severe operative procedure resorted to. In the case of this bursa, as well as of other diseased bursæ in this region, the French surgeons have used injections of iodine, even when a communication with the joint has been known to exist, and without serious results, although some effusion into the articulation has usually taken place. The secret of this is that the injection—and this direction must be strictly adhered to—has been made with the limb strongly extended, in which position, as has been already shown, the opening is so perfectly occluded that no amount of pressure can force the fluid into the articulation.

BICIPITAL BURSA.—This bursa, when enlarged, gives rise to some pain and stiffness of the knee in walking. Over-use of the limb is the cause often assigned, but usually either a rheumatic or a gouty diathesis acts as a powerful predisposing cause. The bursa presents itself as a rounded, thin-walled swelling, situated at the outside and back of the knee, just above the head of the fibula, near the insertion of the biceps. The tendon of this muscle may be either felt gliding *over* the tumor, when the limb is alternately flexed and extended,[3] or apparently the swelling embraces it.[4] It is usually of a moderate size, but may reach that of a large apple. When the knee is flexed, the tumor is slightly mobile and fluctuating; while when the limb is extended, it is fixed and elastic, and does not fluctuate. Except when accidentally inflamed, it is not painful, nor even tender on pressure.

Treatment.—The joint should be kept fixed by an appropriate splint, when some form of counter-irritation, with pressure, or this latter measure with

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[1] Op. cit., pp. 768, 769.
[2] See Section on General Treatment of Bursitis for more special therapeutic directions.
[3] McEwen, loc. cit.   [4] Lancet, vol. xlv. p. 74.

inunction of compound iodine ointment, should be resorted to. If this fails, careful aspiration, followed by counter-irritation, rest, and pressure, is the best treatment. For such cases as resist the above measures, perseveringly carried out, some of the other more radical plans mentioned under the head of Subacute or Chronic Bursitis may be tried. Acute bursitis must be treated, here as elsewhere, upon the general principles already laid down under the appropriate heading.

SEMI-MEMBRANOSUS BURSA.—Here, also, pain and stiffness of the joint are complained of. This bursa, when enlarged, takes the form of a circular—sometimes obliquely ovoid—tense, firm, slightly mobile, non-painful tumor of moderate size, situated at the inner and lower border of the popliteal space. It can hardly come into relation with the artery, and its diagnosis must depend upon the above characteristics and upon its situation.

Treatment.—Rest, with a splint if necessary, pressure after blistering, and in fact those measures suggested for the treatment of the other popliteal bursæ, must be tried.

POPLITEUS BURSA.—I am aware of only one case, recorded by Verneuil,[1] of enlargement of one of these sacs, but of which, seems doubtful. There was in this case also a so-called white-swelling of the knee. The tumor was removed by excision, and the case did well. A bursal tumor in the situation occupied by this sac would probably present the symptoms common to the other popliteal bursæ when enlarged, and should be treated very cautiously upon the principles already laid down, since, although it does not usually communicate with the joint, it may do so. The bursa *beneath* the popliteus tendon, between it and the bone, is, as has already been pointed out, merely a diverticulum of the synovial capsule of the knee-joint, and, in consequence, cannot become enlarged unless the joint also contains some effused fluid, or, either by its history or its present appearances, indicates the previous existence of some articular affection.

EXTERNAL GASTROCNEMIUS BURSA.—The bursa occasionally found beneath the external head of the gastrocnemius, has been in one instance reported as enlarged. There was an obscure, small swelling under the outer head of the muscle, which appeared suddenly during dancing or walking, sometimes compelling rest in bed and active antiphlogistic measures to relieve the agonizing pain, at others being relieved by a few minutes' rest in the horizontal posture. Pain was elicited on pressure, or when the calf-muscles compressed the tumor, either by standing on the toes or strongly flexing the foot. Rest and antiphlogistics, followed by blisters, firm bandaging, and a knee-cap, relieved, but did not cure, this case.[2]

Foucher describes some other bursæ occasionally found in this region, which are so unusual, and of such uncertain origin and symptoms, as not to warrant any special description. Their existence as well as that of the synovial cysts before cited as having been noted by W. M. Baker, should be borne in mind, as their presence may explain conditions found in certain cases, which could not be accounted for by enlargement of any of the normal bursæ of the part.[3]

[1] Mém. de la Soc. de Chirurg., Paris, t. ii. p. 369. [2] Johnson.
[3] I will here express my great indebtedness to the admirable papers of McEwen and Foucher, from which I have chiefly drawn my information, and to which I would refer those desirous of further details upon this interesting but much misunderstood and neglected subject.

BURSÆ OF ANKLE AND FOOT.

A bursal sac is, in tailors, usually developed over both the internal and the external malleolus, especially the latter; one is situated between the os calcis and the tendo Achillis; another on the plantar surface of this bone, over or in front of the tuberosities, beneath the fascia there attached; one on the inner and outer sides of the plantar surface of the metatarso-phalangeal joint of the great toe;[1] one under the plantar surface of the head of the fifth metatarsal bone; another, occasionally, on the plantar surfaces of any or all of the other metatarso-phalangeal joints; one on the dorsal surfaces of the inter-phalangeal joints; one on the dorsum of the foot; another over the tuberosity of the scaphoid; one over the projecting styloid-process of the base of the fifth metatarsal; one over the projecting portion of the head of the astragalus, in patients with flat foot; and others in various situations in cases of club-foot.

RETRO-CALCANEAN BURSA.—Enlargement of this sac is a very rare affection, but as it occasionally simulates disease of the ankle-joint, I have thought it worthy of a special description. Its anatomy differs somewhat from that of other bursæ, in that cartilage forms part of two of its walls, viz., the anterior and posterior, for the vertical portion of the os calcis beneath the tendo Achillis, and the portion of this tendon which faces that part of the bone are both coated with a thin layer of cartilage. This bursa is small and heart-shaped, with its apex upwards, thus forming two pouches, one on each side of the tendon. These lateral pouches have a few bridles of connective tissue traversing them, although not of enough bulk to form even partial partitions. A vascular and fatty fold is usually found in each pouch. Constitutional causes are commonly at the bottom of enlargements of this bursa, although over-exercise by exaggerating the movements of the part is usually the sole cause which is recognized. Traumatism, other than the rubbing of an ill-fitting boot, can hardly ever be a cause, owing to the protected position of the bursa.

Symptoms.—The depression on each side of the tendon is effaced by a fluctuating tumor which elevates it. Local pain and tenderness are complained of, and, when suppuration occurs, heat and redness of the skin are present. Unless there is suppuration, spontaneous pain is rare. Flexion and extension of the foot, either passive or during attempted walking—which is difficult if not impossible—give rise to severe pain in all cases, whether suppurative or not. Contraction of the calf muscles causes more or less acute pain, by making traction on the tendons. In other respects the symptoms resemble those of other inflamed bursæ. Suppuration is not an uncommon sequence, but resolution also occurs, especially in the purely constitutional cases. When the pus is spontaneously evacuated, rest and methodical compression rapidly effect a cure. From its propinquity to the os calcis and the ankle-joint, periarthritic abscess, caries of the calcis, etc., are liable to occur.

Diagnosis.—When the case is seen at the outset, the diagnosis presents no difficulties, but after the formation of pus, some obscurity may arise. The diagnosis must mainly depend on the presence of a fluctuating tumor, before pus could have formed in sufficient quantity to present this symptom; on its limitation to the known site of the bursa; on the local pain produced by

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[1] A. Lenoir (Presse Médicale) says that there are two sacs here: one normal, on the plantar surface; the other, which is accidental, over the side of the head of the metatarsal bone. The plantar sac is found in the fœtus at term, and, strange to say, is relatively larger in the child than in the adult.

flexion and extension, and above all by the voluntary contraction of the calf muscles; on the existence of tenderness on pressure over the tendon; and on the absence of any effusion in the tibio-tarsal joint, which would be shown by swelling in *front* of this articulation. A careful comparison of these symptoms with those of an abscess in this region, or caries, should render the diagnosis possible, although difficult.[1]

Treatment.—This does not differ from that of similar affections elsewhere, but the surgeon must bear in mind the frequency with which the disease depends on gout or rheumatism, so that the proper constitutional treatment may be instituted.

McEwen has described a peculiar affection of the plantar surface of the ball of the great toe, which is evidently bursal. With no history other than that of extreme fatigue from much walking, the patient complains of a chronically painful condition of the part, which interferes with locomotion often to the extent of rendering progression impossible, except by treading upon the outer side of the foot. But little swelling can be observed, and no other symptom except tenderness on pressure. There is not the slightest sign of inflammation, as in bunions. After a long time, in certain cases, a slightly greater fullness over the tender part, with obscure fluctuation beneath the deep plantar ligaments, may be observed. On two occasions McEwen resorted to puncture, giving vent to a synovial fluid. Rest, the use of fomentations, and puncture in extreme cases, have resulted in palliation, but not in cure. This affection must not be confounded with bunion, a description of which follows.

In conclusion, I will say that bursæ have been observed in the following situations, viz., between the end of the bone and the cicatrix, in stumps; over the surface of subcutaneous tumors; over the outer surface of the latissimus dorsi muscle; in the thickness of the labia majora, in women who abuse coitus; at times beneath cicatricial bridles, etc.

I have endeavored to make this list of bursæ and their affections as complete as possible, but, having had to collect my data from very many scattered sources, may have overlooked some few. Finally, I may add that any peculiar habits, use of special instruments, peculiar trades, etc., may give rise to other bursæ whenever the circumstances are favorable for their formation.

BUNION.

A bunion may be defined as an irritated, and consequently enlarged, bursa, situated over one of the tarsal, metatarso-phalangeal, or inter-phalangeal joints, which is distorted. This bursa may be normal or adventitious. The superjacent skin is commonly the site of a corn, or at least is much thickened. Indeed, some authorities state that a bursa is invariably present "in all old and neglected cases" of corn.[2]

Bunions are usually developed over the metatarso-phalangeal joints of the great or little toes. The affection is generally induced by the wearing of improperly shaped shoes, which tend to draw all the toes, but especially the great toe, towards the central axis of the foot. If, in addition, the shoe is too short and high-heeled, distortion is still more favored. Indeed, a shoe of this

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[1] The dull aching pain at the back of the heel, experienced occasionally by adults, but more commonly by children from five to fifteen years of age, and increased by exercise, Barwell thinks is due to inflammation of this bursa.

[2] Bryant, op. cit., p. 145.

kind, even though properly shaped, is of itself an efficient factor of bunions. The normal long axis of each toe coincides with that of its metatarsal bone, and this, if prolonged, passes through the centre of the heel, so that normally the great toe points slightly inwards rather than outwards. The toes should spread when the weight of the body rests upon the foot, the contiguous borders of the first and second being separated by a distinct interval, the second and third closer together, but not in contact, while even the third and fourth do not usually touch. If, then, the digits be confined at their distal ends by a narrow-toed shoe, the weight pressing down an inclined plane, as where high heels are used, the foot will spread at the only possible point, viz., at the metatarso-phalangeal joints, and that of the great toe will form a salient angle inwards. The other toes are then compelled to assume different degrees of flexion, or of flexion of one joint with extension of others, thus favoring the formation of bunions over the salient angles. The skin over the projecting joints becomes thickened and corneous; the bursa, normal or adventitious, is enlarged; and a bunion is fully formed.

Aston Key explains the distortion of the great toe in the following manner: In the young and weakly, by prolonged standing or walking, the anterior tibial muscle, upon which chiefly depends the maintenance of the pedal arch, becomes weakened, and in consequence the anterior segment of the foot tends to rotate outwards. This, through the abnormal position of the astragaloid head, throws the weight upon the inferior calcaneo-scaphoid ligament, which yields. The patient thus becomes flat-footed, and from the rotation outwards of the anterior segment of the foot, the weight is borne on its inner plantar surface, and this gradually forces the great toe obliquely outwards. This explains why the lower classes often present the worst forms of bunion, since, although not wearing tight shoes, they do wear those which are short and badly formed, and are compelled to stand continuously.

The tendency to the formation of bunions is sometimes hereditary; and in such individuals, even properly constructed shoes often fail to avert the disease. Bunions are unknown among the savage races who wear no foot coverings.

The first sign of a bunion is a tender spot over one of the joints which has suffered some degree of distortion, so as to render the articulation salient. Soon the part enlarges from effusion into the normal bursa there situate, or by the formation of an adventitious sac. The disease may now remain stationary, and the patient may suffer no other inconvenience than occasional twinges of pain. Commonly the bursa does not suffice for the protection of the deeper parts, and is subject to recurrent attacks of inflammation, which are characterized by violent, throbbing pain in the affected part, with marked heat, redness and swelling of the integument. The bursa then becomes distended with serum, and, if the inflammation is not checked at this stage, suppuration results, and troublesome ulcers are left, which are not uncommonly the starting-points of senile gangrene. The pus does not always remain confined to the bursa, but is infiltrated into the surrounding tissues. Marked constitutional symptoms are present.

Certain changes which have been thought the result of bad bunion, such as enlargement of the head of the metatarsal bone, the formation of exostoses around its margin, frequent absorption of the cartilage, with an eburnated condition of the subjacent bone, etc., are in all probability the result of rheumatoid arthritis. Other changes, which it is important to note, and which are undoubtedly due to the distortion, are a lengthening of the internal lateral ligament, and a corresponding shortening of the external. This is so marked that, according to T. Smith, the rupture of the latter ligament takes place even in the dead body before the distortion can be overcome. The extensor tendon of the great toe is luxated outwards to a variable

extent. The tendons of the flexor brevis and adductor are likewise situated more externally than natural.

TREATMENT OF BUNION.—From what has been said as to the causes of bunion, it is clear that above all things the treatment should aim at the removal of pressure. This end can be best attained by wearing long, "easy" shoes, taking care, however, that they are sufficiently tight over the instep, to prevent the toes from reaching their extremities, as otherwise the looseness will but add to the evil. The inner border of the toe portion of the sole, which must be as wide if not wider than the foot part, ought to be straight, as in the so-called "waukenphast" shoe. "Boxtoes" are also valuable where the smaller digits are distorted. Until the deviated axes of the toes are restored to their normal line, the projecting angles formed by the distorted joints must remain exposed to irritating pressure. When the great toe only is involved, a separate compartment for it in the shoe is the simplest measure to effect a restoration of the deviated axis. The following apparatus should be worn at night: A band of stout linen or light canvas fitted to the tarsus and meta-tarsus, arranged so as to lace firmly on this portion of the foot, should be provided. Upon its inner side a narrow "casing" should be made for the reception of a piece of spring-steel about half an inch wide, curved in a sigmoid manner so as to fit the concavity of the tarsus and metatarsus by its convexity, while by its concavity facing towards the metatarso-phalangeal joint, pressure is avoided.[1] The joint must be protected by soap-plaster spread on amadou or soft felt. Lacing the band on, and placing the piece of steel in its casing, all that is now required to complete the dressing is to slip a broad rubber band, of such thickness and length as not to produce pain, around the toe and the projecting distal end of the bar. Even as a permanent dressing for the daytime, this simple little apparatus is to be recommended, being quite as efficacious as Bigg's or Sayre's, besides being readily made at home, or at the most requiring the aid of a blacksmith.

The use of one of these devices may prove successful even in the more severe cases. In these latter, if obstinate, subcutaneous section of the external lateral ligament, or of the tendons of the adductor or flexor brevis pollicis, or of all three, may be resorted to advantageously.

When any but the great or little toe is the one affected (as in the deformity known as "hammer-toe"), the simple expedient of passing a strip of adhesive plaster about an inch wide, first *over* the distorted toes and then *under* the normal ones, will often suffice to cure the deformity. Of course the unspread surface must be laid upon the distorted toes, so that the adhesive surface may be applied to the normal ones, which serve to pull the deformed toes into place.[2] Where either incipient or pronounced "flat-foot" is detected, anything like prolonged standing must be strictly interdicted. A steel shank should be fixed in the sole of the shoe. The enfeebled muscles must be stimulated by friction, massage, or electricity, and where these do not avail, a piece of rubber tubing should be employed, after Barwell's method, to aid the weakened muscles in maintaining the proper form of the foot.[3]

As palliatives and adjuvants, the careful removal of the thickened epidermis, and the protection of the sensitive parts by means of soap plaster spread upon leather, either in the form of a ring to remove pressure, or as a continuous covering, should be tried. These means, with proper shoes, rest and emollient applications for a few days, followed, when the inflammation is

[1] A piece of corset-steel will do in an emergency.
[2] Ashton, Med. Times and Gaz., 1852, N. S. vol. v. p. 282.
[3] See Sayre, Orthopædic Surgery, pp. 84, 85.

entirely gone, by painting with tincture of iodine, a simple blister, or an ointment of the biniodide of mercury (gr. x to ℨj), will frequently cure the milder cases where only slight distortion is present. If there is much fluid present, with no attendant inflammation, subcutaneous puncture and discission of the sac, followed by pressure, with or without the use of iodine externally, is good practice.

When the bunion is acutely inflamed, rest in the horizontal posture, with the foot elevated, and the application of an anodyne water-dressing, constitute the best treatment. If suppuration ensue, an early and free incision should be practised. Some caution must be exercised as to incisions in the aged or ill-nourished, in whom gangrene or serious suppuration not infrequently occurs. Cæsar Hawkins finds that even when the bone is laid bare by a suppurating bunion, a cure can often be effected by the use of nitric acid. He removes the superjacent corn as freely as possible, enlarges the orifice of the bursa, and cautiously applies the acid once or twice. When the disease is close to a joint, great caution must be exercised. If the bone be denuded, it should be touched freely but carefully with the acid. This will promote the separation of the necrosed portion, when the bone will probably become covered with healthy granulations.

Stimulating applications, such as resin cerate, etc., with opium and stimulants internally, are safer, when indolent, suppurating sores remain, than laying open the sac. In the young or middle-aged, but only as a last resort, the bursa may be laid open or excised, but, if possible, only with antiseptic precautions. Occasionally the suppuration extends to the adjacent joint, resulting in its destruction, with more or less extensive caries of the bones. If, after a fair trial of rest, free drainage, and appropriate dressings, a cure by anchylosis does not result, I strongly advise amputation through the metatarsal bone, my experience leading me to an unfavorable opinion as to excision of the diseased joint, although this operation has been successfully practised by Kramer, Pancoast, and others.

Perforating Ulcer in its Relations to Bunion.

In studying the literature of this strange affection, it is evident that there is more than one variety of the disease. I have myself no doubt that at least two of its forms are at the outset etiologically the same, though when seen during their later stages it is exceedingly difficult to believe them identical affections. Undoubtedly the course pursued in various cases is due to the difference in the resisting and reparative powers of the patient's tissues. There is certainly no greater variation exhibited by this disease than all surgeons are familiar with in slight injuries of a joint. In a healthy, robust individual, a slight blow or sprain is readily recovered from, while in one who is feeble, sickly, or, though apparently healthy, of a strumous diathesis, a slow form of inflammation is set up, which eventuates in the destruction of cartilage and bone, or perhaps even the patient's life, if relief by art be not afforded. The dependent position of the foot, and its necessary use as an instrument of support and means of progression, render active a latent tissue-defect or constitutional weakness, which elsewhere would escape detection. Whether a third form of perforating ulcer, of the nature of a neurosis, exists or not, it seems in our present state of knowledge impossible to decide absolutely. When describing the symptoms of the several varieties of the disease, I shall endeavor to determine this matter, or at least to give the facts observed, so as to enable the reader to arrive at an intelligent conclusion.

(1) As has been already said, most authorities state that under all neglected

corns, a bursa, or at least a bursal space in the connective tissue, is developed. If from constantly recurring irritation suppuration takes place in this bursa, the pus must fail to reach the surface through the thickened corneous epiderm. Seeking then the point of least resistance, it will eventually open upon the dorsum of the foot. A probe passed through the sinus will impinge upon the plantar corn, which may or may not be traversed by a small opening. In the perfectly healthy there will usually be no disease of any of the joints or bones of the foot. The *treatment* is simple, consisting in rendering drainage efficient by enlarging the plantar opening, and in exciting the callous walls of the sinus to adhesive inflammation by the introduction of a fine silk seton. (2) The second variety, depending as I have already said chiefly upon individual idiosyncrasy, is a much more serious disease, eventuating in a more or less complete destruction of the member, and sometimes even in loss of life. As will be seen hereafter, I know of no means of distinguishing it from (3) the neurotic variety, except by the absence of anæsthetic symptoms, and I shall accordingly describe the two affections together.

SYMPTOMS.—Perforating ulcer (*mal perforant du pied*) was first described by Cloquet, in 1837, and has since been studied by Boyer, Marjolin, Vesigné, Wilks, Péan, Desoul, Masbrenier, Hancock, and numerous later writers. As a rule, it commences in the young, is hereditary, and of long duration, being characterized by a series of attacks alternating with apparent recoveries. Most authorities—Nélaton being the chief dissentient—agree in describing the disease as commencing by the formation of hard plantar corns. These are usually situated over the heads of the metatarsal bones of the great, middle, or little toes, although other parts may be the sites of these callosities.[1] Coincidently with the appearance of the corns, offensive sweating of the feet occurs. Suppuration next takes place, the skin gives way, and in the course of five or six weeks, if the resulting sinus be examined by a probe, bared, necrosed bone will be easily detected, which sooner or later separates—to be removed by art or nature—when a temporary convalescence results. When first seen by the surgeon, nothing will perhaps be found but a hard callosity over one of the metatarso-phalangeal joints, having at its centre a brownish depressed spot. This, on closer examination, shows itself to be a perforation giving vent to sero-pus. Subsequently the foot becomes slightly brawny and swollen. In certain cases, anæsthesia of the opening, and of the surrounding skin, with lowered temperature, will be detected. In others, severe pain in the heel and ankle is complained of. At a later period the tendons become affected, distorting the toes; the nails become yellow and fissured, perhaps laterally twisted; epidermal accumulations form upon the dorsal as well as on the plantar surfaces of the foot, and the integument becomes pigmented. Both feet may be involved, and even the hand has been seen affected by a similar disease. The anæsthesia may extend even above the knee. Nélaton describes the disease as always commencing by phlyctenulæ, which contain pus. These breaking, the true derm, of a rose color and exquisitely sensitive, is laid bare and soon ulcerates. In all other respects Nélaton's account of the disease is identical with that given by Vesigné, Hancock, and others.[2]

The fact that the disease commonly occurs in strumous cases supports the opinion which I have already given as to its nature in the majority of instances. Wilks considers it to be strumous; Vesigné regards it as a variety of plantar psoriasis. The view that it is due to atheroma, etc., was disproved by Masbre-

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[1] Vesigné states that it commences as a bunion, or as a flat corn, with thickening.

[2] Vesigné explains this discrepancy by showing that Nélaton saw cases at a later period of the disease, when, as in several of his own cases, phlyctenulæ were the starting-point of *secondary*, though never of *primary* attacks.

nier and Picot, who demonstrated that it occurred in those whose vessels were even microscopically sound. Doubtless, however, where atheroma or endarteritis exists, it is a factor in the development of the disease. Poncet, in 1864,[1] Duplay and Morat in 1873,[2] Savory and Butlin in 1879,[3] and other writers, have demonstrated a thickening of the endoneurium of the nerves of the part, resulting in partial destruction of the nerve-fibres. Some of these writers consider these changes to be secondary to the ulceration, while others, especially Messrs. Savory and Butlin, believe that they are the cause of the disease, and that the sensory and nutritive fibres mainly suffer, while the "motor fibres escape owing to their larger size and thicker medullary sheaths."

As before said, I believe that there are probably three varieties of perforating ulcer, viz.: (1) one arising from a suppurating bursa beneath a corn in healthy subjects, and without subsequent bone disease; (2) a second, arising as the first, but in subjects of a strumous or broken-down constitution, and ending in extensive destruction of the bones, etc.; and (3) a third, where there is either primarily, as is most probable, or secondarily, disease of the nerves, which is accompanied by anæsthesia of the parts. My reasons for not thinking that all severe cases of perforating ulcer are due to a neurotic element, have been partially given already, but I shall now present a few other reasons, as briefly as possible. Not all cases of this disease are accompanied by anæsthesia, but some on the contrary are painful. The disease is limited to the anterior segment of the foot. A Pirogoff or Syme amputation is almost invariably successful, though such an operation only insures that the integuments of the stump are such as are tough and habituated to pressure, while they can produce no more effect upon a nerve lesion than partial amputations through other portions of the foot, which latter, however, fail, because ulceration from pressure, etc., soon arises in the abnormally placed and comparatively tender skin which in them forms the flaps at the joints pressed upon; the anæsthesia may extend to the knee, yet after a Syme or Pirogoff amputation the disease does not usually recur. Finally, the view that this disease is caused by the atrophy of the sensory and trophic fibrils is purely theoretical, especially in view of the great doubt as to whether the latter exist at all. Upon the other hand, similar ulcerations have been observed in cases of locomotor ataxia, anæsthetic leprosy, and progressive muscular atrophy, and in cases of compression of nerve trunks; and I would suggest that certain of the so-called cases of perforating ulcer should—and would, if the patients were more carefully examined—be classed among the mild and obscure cases of some of the affections just mentioned. I do not deny that there may be a neurotic form of perforating ulcer, but believe that the affection is not invariably of that character, and that in the present state of our knowledge we cannot say positively what share the altered nerves have in producing the disease.

I may now briefly recapitulate the distinctive features of perforating ulcer, which render it difficult to confound with any other disease, even with that most resembling it, the so-called tubercular disease of the foot. (1) It commences by corns under the metatarso-phalangeal joints; (2) It is confined to the anterior part of the foot; (3) There is offensive sweating of the foot; (4) There is no evidence of tubercle; (5) There is only moderate swelling; (6) The disease—or rather the tendency to it—is hereditary.[4]

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[1] Rec. de Mém. de Méd. de Chir. et de Pharm. Milit., 1864.
[2] Archives Gén. de Méd., Mars, Avril, Mai, 1873.
[3] Medico-Chirurgical Trans., second series, vol. xliv. 1879, pp. 373–393, with plates.
[4] See Hancock on the Anatomy and Surgery of the Human Foot, 1873, pp. 59–76; also Nélaton, Gaz. des Hôpitaux, Paris, Jan. 1852; Vesigné, loc. cit., Fév. 1852, and the other authors mentioned in the body of this section.

TREATMENT OF PERFORATING ULCER.—Of course all that will improve the general health is advisable, and one medicine vaunted by Vesigné should be tried in small doses, although probably useful only as a tonic, viz., Fowler's solution.   As a palliative, the use of an artificial limb applied to the flexed leg, has been recommended, as removing pressure and irritation.   When no operation is advisable, or possible, it should be tried.   When operative interference seems indicated, I consider it of prime importance to ascertain if anæsthesia of the skin be present.   When this is marked, the operation should at least remove the portion of the member which is anæsthetic.   If the sensibility of the leg is much affected, and the patient's general condition is not good, an amputation just below the knee would probably give the best result.   When the sensibility of the heel is preserved, a Syme's, Pirogoff's, or sub-astragaloid amputation should be resorted to.   This is usually found effectual in staying the further progress of the disease, as this is, almost invariably, strictly limited to the anterior segment of the foot.   When, on the other hand, no anæsthesia is present, and the disease is limited, a mere removal of the necrosed portions of bone, attention to the general health, and appropriate dressings will usually prove effectual.   By attention to these rules I think that, upon the one hand, no unnecessarily severe measures will be resorted to, and that, upon the other hand, when an operation is undertaken, it will not have to be repeated.[1]

[1] I would here express my indebtedness to Mr. Ralph W. Seiss for much valuable aid in making notes and abstracts of cases, which have greatly aided me in the preparation of this article.

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